DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

WATER-SUPPLY PAPER 274

SOME STREAM WATERS OF THE WESTERN UNITED STATES

WITH CHAPTERS ON

SEDIMENT CARRIED BY THE RIO GRANDE AND THE INDUSTRIAL APPLICATION OF WATER ANALYSES

BY

HERMAN STABLER

Analyses of river waters by chemists of the United States Reclamation Service

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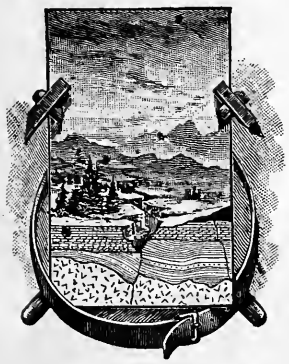

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SOME STREAM WATERS OF THE WESTERN UNITED STATES.

By Herman Stabler.
[Analyses by chemists of the United States Reclamation Service.]

INTRODUCTION.

HISTORY OF THE INVESTIGATIONS.

A systematic study of the waters likely to be utilized on the Reclamation Service projects was made in order to determine the influence of the salinity of the waters on the growth of vegetation and the effect of suspended matter in silting canals and reservoirs.

The work was begun early in 1905, under the direction of Thomas H. Means, engineer, and was continued during 1906 and until May, 1907, under the direction of W. H. Heileman, engineer. The analyses were made in a laboratory established at quarters provided by the University of California at Berkeley, Cal., by C. H. Stone, P. L. McCreary, F. M. Eaton, O. J. Hawley, W. C. Riddell, F. T. Berry, H. A. Burns, J. H. Hampson, J. A. Pearce, and M. Vaygouny, the greater part of the work being that of the first five named. C. H. Stone was chemist in charge at the beginning of the investigations and is chiefly responsible for the plan of the analytical work and the methods of analysis.

The results of the investigations were prepared for publication under instructions from F. H. Newell, Director of the United States Reclamation Service, by Herman Stabler, assistant engineer, who assembled and checked the analyses, compiled the accompanying stream-flow data from records of the United States Geological Survey, and computed daily discharge of suspended matter and dissolved solids, under the supervision of D. W. Murphy, engineer in charge of Washington office engineering.

COLLECTION OF SAMPLES.

Samples were collected for an extended period at 55 stations, located for the most part at established gaging stations of the United States Geological Survey in order that stream-flow data concurrent with the analyses might be obtained.

The general plan of sample collection provided for the taking of 4 ounces of water each day at each of the regular stations. The point

of collection was selected with a view to obtaining a fair average sample of the water flowing in the stream, and occasionally samples were taken from different parts of the cross section in order to determine any possible local variation in quality of water. The general plan could not be followed absolutely, and the records show numerous gaps caused by noncollection of samples, loss of samples in transit, or by other reasons.

The results of the work are here presented in alphabetical order by stream names and, under the stream names, by station names. The following lists classify the stations by drainage basins and by States.

Sampling stations, by drainage basins.

Colorado River basin:
- Colorado River near Yuma, Ariz.
- Green River near Green River, Wyo.
- Jensen, Utah.
- Grand River basin:
  - Grand River near Kremmling, Colo.
  - Palisade, Colo.
  - Gunnison River near Whitewater, Colo.
- San Juan River basin:
  - Animas River near Durango, Colo.
- Little Colorado River near Holbrook, Ariz.
- Woodruff, Ariz.
- Gila River basin:
  - Gila River near San Carlos, Ariz.
  - San Francisco River near Alma, N. Mex.
  - Salt River basin—
    - Salt River near Roosevelt, Ariz.
    - Verde River near McDowell, Ariz.

Columbia River basin:
- Snake River basin:
  - Boise River near Boise, Idaho.
  - Malheur River near Vale, Oreg.
  - Payette River near Horseshoe Bend, Idaho.
- Palouse River near Hooper, Wash.
- Okanogan River basin:
  - Salmon Creek near Malott, Wash.

Great Basin:
- Carson River near Hazen, Nev.
- Truckee River near Derby, Nev.
- Owens River near Round Valley, Cal.
- Tinemaha, Cal.

Klamath River basin:
- Link River near Klamath Falls, Oreg.

Mississippi River basin:
- Missouri River basin:
  - Milk River near Havre, Mont.
  - Yellowstone River basin:
    - Yellowstone River near Billings, Mont.
    - Glendive, Mont.

Mississippi River basin—Continued.
Missouri River basin—Continued.
Yellowstone River basin—Continued.
Bighorn River basin:
Bighorn River near Fort Custer, Mont.
Shoshone River near Cody, Wyo.
Cheyenne River basin:
Belle Fourche River at county bridge near Belle Fourche, S. Dak.
diversion dam near Belle Fourche, S. Dak.
Redwater River near Belle Fourche, S. Dak.
Arkansas River basin:
Canadian River basin:
Sapello River near Los Alamos, N. Mex.
Red River basin:
Salt Fork of Red River—
Salt Fork of Red River near Mangum, Okla.
Turkey Creek near Olustee, Okla.
North Fork of Red River:
North Fork of Red River near Granite, Okla.
Headrick, Okla.
Elm Fork near Mangum, Okla.
Rio Grande basin:
Rio Grande near San Marcial, N. Mex.
El Paso, Tex.
Pecos River basin:
Pecos River near Santa Rosa, N. Mex.
near Dayton, N. Mex.
at Carlsbad, N. Mex.
Gallinas River near Las Vegas, N. Mex.
Hondo River near Roswell, N. Mex.
Sacramento River basin:
Sacramento River near Red Bluff, Cal.
at Sacramento, Cal.
Pit River near Bieber, Cal.
Stony Creek near Fruto, Cal.
Feather River basin:
Feather River near Oroville, Cal.
Yuba River near Smartsville, Cal.
American River near Fairoaks, Cal.
Puta Creek near Winters, Cal.
San Joaquin River basin:
Tuolumne River near La Grange, Cal.

Sampling stations and streams, by States.

Arizona:
Holbrook, Little Colorado River.
McDowell, Verde River.
Roosevelt, Salt River.
San Carlos, Gila River.
Woodruff, Little Colorado River.
Yuma, Colorado River.
California:
Bieber, Pit River.
Fairoaks, American River.
Fruto, Stony Creek.

California—Continued.
La Grange, Tuolumne River.
Oroville, Feather River.
Round Valley, Owens River.
Red Bluff, Sacramento River.
Sacramento, Sacramento River
Smartsville, Yuba River.
Tinemaha, Owens River.
Winters, Puta Creek.
Colorado:
Durango, Animas River.
Kremmling, Grand River.
Palisade, Grand River.
Whitewater, Gunnison River.
Idaho:
Boise, Boise River.
Horseshoe Bend, Payette River.
Montana:
Billings, Yellowstone River.
Fort Custer, Bighorn River.
Glendive, Yellowstone River.
Havre, Milk River.
Nevada:
Derby, Truckee River.
Hazen, Carson River.
New Mexico:
Alma, San Francisco River.
Carlsbad, Pecos River.
Dayton, Pecos River.
Las Vegas, Gallinas River.
Los Alamos, Sapello River.
Roswell, Hondo River.
San Marcial, Rio Grande.
Santa Rosa, Pecos River.
North Dakota:
Williston, Missouri River.
Oklahoma:
Granite, North Fork of Red River.
Headrick, North Fork of Red River.
Mangum, Elm Fork.
Mangum, Salt Fork of Red River.
Olustee, Turkey Creek.
Oregon:
Klamath Falls, Link River.
Vale, Malheur River.
South Dakota:
Belle Fourche, Belle Fourche River at county bridge.
Belle Fourche, Belle Fourche River at diversion dam.
Belle Fourche, Redwater River.
Texas:
El Paso, Rio Grande.
Utah:
Jensen, Green River.

Washington:
Hooper, Palouse River.
Malott, Salmon Creek.
Wyoming:
Cody, Shoshone River.
Fort Laramie, North Platte River.
Green River, Green River.

In addition to the analyses of samples taken at these regular stations, many analyses were made of samples collected from various miscellaneous sources. The results of these miscellaneous analyses are tabulated under appropriate headings on pages 141 to 149.

PLAN OF ANALYTICAL WORK.

Equal volumes of the individual samples were united to form composite samples representing the average quality of the water of each stream for a week. The weekly samples were analyzed quantitatively for total solids, dissolved solids, and the carbonate, bicarbonate, and chlorine radicles, and qualitatively for the sulphate radicle. Remainders of the weekly composites were combined in sets of four representing the collections for a month. The monthly composites thus obtained were analyzed quantitatively for dissolved solids and the calcium, magnesium, sodium and potassium, carbonate, bicarbonate, sulphate, chlorine, and nitrate radicles. The suspended matter from the monthly composites for some streams was accumulated and analyzed. Variations from the regular plan of analytical work are shown by the dates of samples in the tables.

METHODS OF ANALYSIS.

The analyses are reported in milligrams per liter, a unit which for little-mineralized water is practically synonymous with parts per million and which was selected because it can more accurately represent the high mineral content of such waters as are found in some of the western streams.

Of the weekly composites 50 cubic centimeters was taken and total solids were determined by evaporating to dryness on a steam bath, drying for one hour at 110° C., cooling in a desiccator, and weighing. Solids were estimated on both filtered and unfiltered samples, and the difference between the two determinations was tabulated as suspended matter. Of the monthly composites 200 cubic centimeters of filtered water was taken for the dissolved solids determination.

Great difficulty was experienced in securing clear filtrates for the determination of dissolved solids and the radicles because of the great quantity of very fine material carried in suspension by many of the streams. For the first few months a filter pump was used successfully and then the Shimer method[a] was adopted, the procedure being

[a] Jour. Am. Chem. Soc., Mar., 1905.

about as follows: A Swedish filter paper, beaten to a pulp in a paraffin vessel with hydrochloric and hydrofluoric acids and washed, was spread on a felt pad placed in the bottom of a long cylindrical glass tube tightly fitted to a suction flask. The sample to be filtered was placed in the cylindrical tube and suction applied. When sufficient filtrate had been obtained the filter was washed with distilled water to prepare it for the next sample.

Carbonate, bicarbonate, and chlorine radicles were in general determined as follows: Fifty cubic centimeters of the filtered sample was placed in a dish, phenolphthalein indicator added, and titration made with sodium acid sulphate solution to the end point; methyl orange indicator added and titration continued to a second end point; potassium chromate indicator added and titration with silver nitrate made to a third end point. The titrations with sodium acid sulphate furnished data for the calculation of carbonate and bicarbonate radicles and the titration with silver nitrate furnished data for the calculation of the chlorine radicle. In analyzing some of the more concentrated waters less than 50 cubic centimeters of water was used.

Calcium, magnesium, sodium and potassium, and sulphate radicles were determined gravimetrically by the methods of Fresenius. In a few analyses separation of sodium and potassium was made gravimetrically. The figure representing sodium and potassium together was obtained by calculating the weight of their combined chlorides to sodium. The result is in reality the amount of sodium plus three-fourths the potassium, and is so reported in the tables. Where sodium and potassium were separated these bases are reported in terms of per cent of $(Na + \frac{3}{4}K)$.

The nitrogen and other determinations of sanitary analyses were made in accordance with the standard methods of the American Public Health Association.

Special methods of analysis were used from time to time, and for the Colorado at Yuma the methods used by Forbes[a] in previous work on this stream were adopted. These methods differed from those used on other streams as follows: All evaporations were made in porcelain instead of silver or platinum, the liquid was measured in a pipette instead of a flask, the dissolved solids were determined on the clear supernatant liquid after standing several days instead of on a filtered portion of the sample, and 100 cubic centimeters was used for the solids determinations instead of 50 cubic centimeters.

ACCURACY OF WORK AND TABLES.

The partial analyses of weekly composites have been checked as far as possible and the qualitative determinations of sulphates and all apparently erroneous values have been omitted.

[a] Forbes, R. H., The river irrigating waters of Arizona: Bull. 44, Univ. Arizona Agr. Exper. Sta.

As the remainders of the weekly composites used for the monthly composites were not united in equal parts or in proportion to stream flow, the analytical results may not represent with great accuracy the mean quality of the water or the quality of the mean flow. The monthly analyses are therefore presented in terms of per cent of dissolved solids, for the percentage composition varies little with changes in stream flow. The per cents are not intended to indicate the percentage composition of the dissolved solids but are merely ratios, expressed as per cent, of the various radicles to the dissolved solids determinations. The actual quantities in milligrams per liter of the various radicles may be estimated by applying the tabulated per cents to the mean of the dissolved solids results of the weekly analyses for any period. In the summary (pp. 139–140) the quantities of radicles in milligrams per liter were obtained by such a calculation, the mean dissolved solids from the monthly analyses being taken as a basis of computation.

The accuracy of the monthly analyses has been checked by comparing the sum of the radicles with the total solids and the sum of the reacting values of the positive radicles with the sum of the reacting values of the negative radicles; apparently erroneous results that could not be corrected from the original notebooks have been discarded. In checking by reacting values it was found that most of the apparent percentage errors (found by dividing the algebraic sum by the arithmetical sum of the reacting values) were less than the value of the expression $3+\frac{1500}{\text{dissolved solids}}$, which was adopted as the maximum allowable error. The word "error" is here applied to apparent lack of closure in the chemical system of dissolved solids. The so-called error may result from undetermined radicles as well as from erroneous analytical results.

The following table shows the maximum error allowed by this expression for various amounts of dissolved solids:

Maximum allowable errors in reacting values.

Dissolved solids (milligrams per liter).	Error (per cent).	Dissolved solids (milligrams per liter).	Error (per cent).
80	21.7	360	7.3
90	19.7	400	6.8
100	18.0	450	6.3
110	16.6	500	6.0
120	15.5	600	5.5
130	14.5	700	5.1
140	13.7	800	4.9
150	13.0	900	4.7
160	12.4	1,000	4.5
180	11.3	1,200	4.2
200	10.5	1,500	4.0
220	9.8	2,000	3.8
240	9.2	5,000	3.3
260	8.8	7,500	3.2
300	8.0	15,000	3.1

The percentage errors in reacting values are shown in the tables of the analyses. The mean of the errors of analyses arranged by content of dissolved solids of the waters are given in the following table:

Mean errors of analyses of monthly composite samples.

Dissolved solids in milligrams per liter.	Number of analyses.	Mean error (per cent).
75 to 99 (mean 91)	16	10.0
100 to 149 (mean 123)	42	7.0
150 to 199 (mean 169)	39	5.9
200 to 299 (mean 247)	50	4.8
300 to 499 (mean 391)	81	3.7
500 to 999 (mean 730)	59	2.4
1,000 to 4,990 (mean 2,490)	73	1.8
5,000 to 21,600 (mean 9,600)	13	1.1

Some idea of the accuracy of the individual determinations may be gathered by considering the errors inherent in the methods of analysis employed. Titrations made in the ordinary way are all likely to be in error by 0.05 cubic centimeter of the solution and weighings are likely to be wrong by at least 0.5 milligram.

The following table shows the errors thus likely to be introduced into the tabulated analyses for the amounts of water and strengths of solutions generally used for the analyses. Errors greater than these are, of course, not unlikely through blunders in the analytical work, the table showing merely in a general way the minimum refinement probable in the work at Berkeley:

Errors likely to occur in individual analyses.

Determination or radicle.	Assumed error of analytical work.	Quantity of water used (cubic centimeters).	Resulting error in analysis (milligrams per liter).
Suspended matter	0.5 mg.	50	10
Do	0.5 mg.	100	5
Dissolved solids	0.5 mg.	50	10
Do	0.5 mg.	200	2.5
Calcium	0.5 mg.	200	1.8
Magnesium	0.5 mg.	200	.5
Sodium and potassium	0.5 mg.	200	1.0
Carbonate [a]	0.05 c. c.	50	2.3–3.2
Bicarbonate [a]	0.05 c. c.	50	2.4–3.3
Sulphate	0.5 mg.	200	1.0
Chlorine [a]	0.05 c. c.	50	2.3–5.0

[a] The range in resulting errors is due to the use of solutions of different strengths.

RESULTS AT SAMPLING STATIONS.

AMERICAN RIVER NEAR FAIROAKS, CAL.

Samples of water were collected from American River at Fairoaks Bridge, near Fairoaks, Cal., from July 9 to August 12, 1905, near the gaging station established by the United States Geological Survey November 3, 1904. Stream-flow data, including gage heights,

rating tables, and estimates of discharge, for the gaging station have been published by the Survey in the following reports:

Water-Supply Papers: 134, pp. 145–146; 177, pp. 176–178; 213, pp. 146–147; 251, pp. 221–225.

Additional information in regard to the quality of the water of American River is contained in Water-Supply Paper 237, "Quality of California surface waters," pages 41–43.

Partial analyses, gage heights, and rates of discharge of water and solids for American River at Fairoaks Bridge, near Fairoaks, Cal.

[Drainage area, 1,900 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905.									
July 9, 10, 11, 12, 14, 15	0	47	9	92	80	2.15	815	202	176
July 16, 17, 18, 19	0	68	16	20	106	1.75	530	29	152
August 6, 7, 8, 9, 10, 11, 12	0	71	11	144	116	1.30	295	115	92

NOTE.—Analysis of a composite of the 17 daily samples collected between July 9 and August 12 gives dissolved solids 125 milligrams per liter; and radicles, in per cent of dissolved solids, as follows: Ca, 10; Mg, 3.8; Na+¾K, 18; CO_3, 0.00; HCO_3, 46; SO_4, 13; Cl, 10; and NO_3, 0.18; Na is 96 per cent of the Na+¾K and K is 6.3 per cent.

Monthly discharge, in second-feet, of American River near Fairoaks, Cal.

Month.	1904.	1905.	1906.	1907.	1908.	Mean.
January	.....	3,550	7,010	3,750	2,860	4,290
February	.....	4,630	5,830	14,400	2,090	6,740
March	.....	6,920	13,900	23,900	3,640	12,100
April	.....	7,740	12,100	15,600	5,150	10,100
May	.....	6,720	15,000	12,200	5,360	9,800
June	.....	3,230	15,900	11,100	2,780	8,250
July	.....	719	6,180	5,290	970	3,290
August	.....	255	1,010	1,290	250	701
September	.....	126	433	565	134	314
October	.....	138	338	438	446	340
November	[a] 896	181	567	573	504	544
December	1,400	242	3,900	1,560	641	1,550
The year	.....	2,870	6,850	7,560	2,060	4,830

[a] November 4–30.

ANIMAS RIVER NEAR DURANGO, COLO.

Samples of water were collected from Animas River at a highway bridge near Durango, Colo., between March 19 and December 18, 1905. A gaging station was established at this bridge by the United States Geological Survey June 20, 1895, and was discontinued December 31, 1905. Stream-flow data, including gage heights, rating tables, and

estimates of discharge, for the station have been published by the Survey in the following reports:

Annual Reports: 18, IV, pp. 283–285; 19, IV, pp. 414–415; 20, IV, pp. 59, 379, 403; 21, IV, p. 301; 22, IV, p. 394.
Bulletin 140, pp. 198–200.
Water-Supply Papers: 11, p. 72; 16, p. 146; 28, pp. 132, 139, 142, 145; 38, pp. 310–311; 39, p. 452; 50, pp. 383–384; 52, p. 520; 66, pp. 97, 174; 74, p. 122; 85, pp. 35–37; 100, pp. 51–54; 133, pp. 183–186; 175, pp. 134–137.

Partial analyses, gage heights, and rates of discharge of water and solids for Animas River at highway bridge near Durango, Colo.

[Drainage area, 810 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905.									
March 19, 20, 21, 22, 23, 24	0	169	22	159	458	7.4	500	215	619
March 26, 27, 28, 29, 30, 31	0	159	22	386	388	7.5	525	547	550
April 2, 3, 4, 5, 6, 7	0	142	20	1,270	294	8.0	777	2,660	617
April 10, 11, 22	0	142	15	536	290	8.6	1,270	1,840	994
April 23, 24, 25, 26, 27, 28	0	134	10	308	244	9.3	2,110	1,760	1,390
April 30, May 1, 2, 3, 4, 5, 6	6	109	13	176	226	9.7	2,810	1,340	1,720
May 14, 18, 19, 20, 21	0	97	8	186	146	10.9	5,060	2,520	1,990
May 22, 23, 24, 25, 26, 27	0	84	8	238	140	11.7	6,500	4,180	2,460
May 28, 29, 30, 31, June 1, 2	0	89	8	202	148	11.4	6,020	3,280	2,410
May 7, 8, 9, 11, 12, June 1, 3	0	112	10	176	194	9.7	3,070	1,460	1,610
June 17, 18, 19, 20, 21, 22, 23	0	79	9	74	168	11.2	6,230	1,250	2,830
July 24, 25, 26, 27, 28, 29	0	131	26	28	310	8.0	1,470	111	1,230
July 30, 31, August 1, 2, 3, 4, 5	0	161	18	38	236	8.3	1,840	189	1,170
August 6, 7, 8, 9, 10, 11	0	116	20	78	308	7.7	1,100	231	915
August 13, 14, 15, 16, 17, 18, 19	0	122	25	8	348	7.2	647	14	608
August 20, 21, 22, 23, 24, 25, 26	0	116	42	18	396	7.0	490	24	525
August 27, 28, 29, 30, 31, September 1, 2	0	118	37	48	322	7.0	470	61	408
September 3, 4, 5, 6, 7, 8, 9	2	136	30	42	346	7.0	470	53	439
September 10, 11, 12, 13, 14, 15, 16	12	124	28	56	390	6.9	427	65	450
September 17, 18, 19, 20, 21, 22, 23	0	167	27	0	460	6.8	359	0	446
September 24, 25, 26, 27, 28, 29, 30	0	112	21	190	254	7.4	897	460	615
October 1, 2, 3, 4, 5, 6, 7	10	115	24	106	318	7.5	876	251	752
October 8, 9, 10, 11, 12, 13, 14	5	138	28	36	390	7.0	510	49	536
October 15, 16, 27, 28	0	84	30	122	368	6.9	395	130	392
October 29, 30, 31, November 1, 2, 4	6	159	33	198	282	6.8	360	193	274
November 18, 19, 20, 21, 22, 24, 25	0	176	30	36	460	6.7	283	28	352
November 26, 27, 28, 29, 30, December 1, 2	0	178	42	16	564	6.7	290	13	442
December 3, 4, 5, 6, 7, 8, 9	0	187	42	0	524	6.6	240	0	339
December 10, 11, 12, 13, 14, 15, 16	0	161	37	32	532	6.6	240	21	344
December 17, 18	0	175	36	36	452	6.6	240	23	293

Relative amount of substances in solution in water from Animas River at highway bridge near Durango, Colo.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium (Na+K).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905.											
March 19–April 28	27	+2.8	328	22	4.0	7.0	0.00	47	35	4.3	0.08
April 30–May 27	25	+3.8	174	22	5.1	6.3	.00	61	25	6.3	.02
May 28–August 5	26	.....	197	.....	3.3	.....	.00	48	26	6.6	.07
August 6–September 2	27	.....	328	23	4.0	8.5	.00	.....	34	6.7	.05
September 3–30	28	.....	373	.....	3.0	8.0	.00	42	38	8.6	.05
October 1–November 4	24	.....	408	21	3.9	.....	.00	37	33	8.6	.07
November 18–December 16	28	+ .7	458	21	3.5	8.3	.00	38	37	8.5	.07
Mean	.....	2.4	324	22	3.8	7.6	.00	46	33	7.1	.06

Monthly discharge, in second-feet, of Animas River near Durango, Colo.

Month.	1895.	1896.	1897.	1898.	1899.	1900.	1902.	1903.	1904.	1905.	Mean.
January	.....	.....	[a] 310	[a] 378	.....	[a] 179	.....	.....	.....	.....	289
February	.....	.....	[a] 284	[a] 267	.....	[a] 133	.....	.....	.....	.....	228
March	.....	.....	[a] 374	[a] 306	.....	[a] 224	.....	.....	.....	.....	301
April	.....	[b] 1,630	2,610	1,510	584	335	445	.....	.....	1,460	1,220
May	.....	2,330	4,500	1,760	1,730	2,180	1,700	3,240	.....	3,890	2,670
June	[c] 646	875	3,220	3,430	1,800	1,990	1,180	4,130	.....	6,300	2,620
July	388	349	1,120	1,360	668	409	271	2,450	[c] 453	1,820	929
August	510	199	534	364	691	179	273	554	903	816	502
September	363	1,000	875	263	276	231	299	542	738	534	512
October	307	475	1,380	161	297	252	256	347	1,680	522	568
November	246	274	553	158	267	205	.....	.....	511	290	313
December	[c] 251	[c] 216	430	[c] 250	[c] 212	[c] 272	.....	.....	[d] 339	243	277
The year	.....	.....	1,350	851	.....	549	.....	.....	.....	.....	869

[a] Approximate. [b] April 12–30. [c] June 20–30. [d] December 1–17.

BELLE FOURCHE RIVER NEAR BELLE FOURCHE, S. DAK.

Samples of water were collected from Belle Fourche River at a county bridge near Belle Fourche, S. Dak., between April 15, 1905, and June 23, 1906. A gaging station was established at this bridge by the United States Geological Survey May 26, 1903, and was discontinued June 23, 1906. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for the station have been published by the Survey in the following reports:

Water-Supply Papers: 99, pp. 57–59; 130, pp. 169–172; 172, pp. 156–159; 208, pp. 128–129.

Partial analyses, gage heights, and rates of discharge of water and solids for Belle Fourche River at county bridge near Belle Fourche, S. Dak.

[Drainage area, 3,250 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO^3).	Bicarbonate radicle (HCO^3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–6.									
April 15, 16, 17, 18	10	174	10	58	1,300	1.7	95	15	333
April 19, 20, 22	27	172	7	82	1,220	1.7	85	19	281
April 23, 24, 25, 27, 28, 29	18	187	13	58	1,290	1.6	82	13	289
April 30, May 1, 2, 3, 4, 5, 6	0	131	14	2,810	934	2.3	270	2,050	680
May 7, 8, 10, 11, 12, 13	14	122	7	986	912	2.3	236	629	581
May 14, 15, 16, 17, 18, 19	12	155	7	262	788	2.0	142	100	302
May 21, 22, 24, 25, 26	10	159	14	3,270	844	2.3	270	2,380	615
May 28, 29, 30, 31, June 1, 2, 3	7	144	11	1,520	712	1.8	147	603	282
June 5, 6, 7, 8, 9, 10	20	175	14	86	1,100	1.7	93	22	275
June 11, 12, 13, 14, 15, 16, 17	12	144	10	3,750	936	2.5	382	3,860	965
June 19, 20, 21, 22, 23, 24	0	138	8	6,170	504	3.2	598	9,960	815
June 25, 26, 27, 28, 29, 30, July 1	0	149	15	2,910	696	2.7	365	2,870	686
July 2, 3, 4, 5, 6, 7, 8	0	130	13	7,120	522	3.6	927	17,800	1,310
July 9, 10, 11, 12, 13, 14, 15	0	172	8	1,150	650	2.6	360	1,120	632
July 16, 17, 18, 19, 20, 21	0	170	14	1,380	724	2.3	238	887	465
July 23, 24, 25, 26, 27, 28, 29	0	125	12	7,330	520	3.2	670	13,200	940
July 30, 31, August 1, 2, 3, 4, 5	2	138	6	5,230	492	3.4	699	9,860	929
August 7, 8, 9, 10, 11, 12	0	126	16	2,730	454	2.6	379	2,790	465
August 13, 14, 15, 16, 17, 18, 19	0	139	8	3,910	484	3.8	1,110	11,700	1,450
August 20, 21, 22, 23, 24, 25, 26	0	172	8	434	678	2.0	165	194	302
August 27, 28, 29, 30, 31, September 1, 2	3	167	13	1,490	836	1.9	129	520	291
September 3, 4, 5, 6, 7, 8, 9	0	185	7	302	988	1.7	88	72	234
September 10, 11, 12, 15, 20, 21, 22	0	229	8	140	1,040	1.5	62	23	174
September 22, 23, 24, 25, 26, 27, 29	0	227	16	58	1,050	1.5	63	10	178
October 3, 4, 5, 6, 7, 8, 9	0	177	10	634	880	2.0	170	291	404
October 10, 11, 12, 13, 14, 15, 16	10	186	9	142	862	1.7	87	33	201
October 17, 18, 19, 20, 21, 22, 23, 24	6	166	11	484	856	1.7	90	118	208
October 25, 31, November 1, 2, 3, 4	0	234	28	118	1,120	1.7	90	29	271
November 6, 7, 8, 9, 10, 11	6	222	13	64	1,040	1.7	90	16	251
November 12, 13, 14, 15, 16, 17	0	247	10	56	1,170	1.7	89	13	282
November 24, 25	0	208	11	156	1,120	1.6	75	32	227
April 1, 2, 3, 4, 5, 6, 7	0	140	15	1,780	524	3.7	923	4,430	1,300
April 9, 10, 11, 12, 13, 14	0	182	20	752	780	2.8	430	874	906
April 14, 15, 17, 18	0	188	5	694	834	2.6	352	670	793
May 16, 18, 19	0	172	5	1,150	956	2.2	200	620	517
May 20, 21, 22, 23, 24, 25, 26	0	308	5	3,260	874	3.0	656	5,780	1,550
May 27, 29, 30, 31, June 1, 2	0	144	10	3,080	624	4.0	1,130	9,390	1,900
June 3, 4, 5, 6, 7, 8, 9	0	122	10	2,840	644	2.9	445	3,440	778
June 11, 12, 13, 15, 16	0	153	10	1,940	676	2.8	400	2,100	730
June 17, 18, 19, 20, 22, 23	0	137	10	5,450	796	3.4	850	12,500	1,830

Relative amount of substances in solution in water from Belle Fourche River at county bridge near Belle Fourche, S. Dak.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905–6.											
April 15–May 6	20	+1.9	1,160	17	4.5	5.9	0.00	17	54	0.84	0.01
May 7–June 3	24	−1.8	800	16	4.4	5.5	1.00	20	49	.96	.04
June 5–July 1	26	+0.4	804	16	4.3	7.7	.00	21	52	1.6	.04
July 2–29	27	−5.3	592	14	4.2	[a] 7.3	.00	27	47	2.5	.03
July 30–August 26	27	.....	546	.....	4.4	7.5	.00	28	47	1.3	.05
August 27–September 28	28	.....	1,020	.....	4.5	5.5	.00	19	53	.83	.02
October 3–November 4	28	.....	946	.....	4.8	4.8	.00	21	53	1.5	.03
November 6–25	14	−1.8	1,210	15	5.0	5.8	.00	19	48	5.6	.04
April 1–May 19	20	.....	728	15	4.1	3.7	.....	.....	48	.....	.....
May 20–June 16	25	−4.4	689	15	4.1	8.7	.00	21	53	4.4	.03
June 17–23	6	+4.0	788	15	4.3	12	.00	20	51	3.8	.01
Mean	.....	2.8	844	15	4.4	6.8	.10	21	50	2.3	.03

[a] Sodium is 86 per cent and potassium is 18 per cent of this amount.

Monthly discharge, in second-feet, of Belle Fourche River at highway bridge near Belle Fourche, S. Dak.

Month.	1903.	1904.	1905.	1906.	Mean.
January	.....	.....	.....	.....	[a] 150
February	.....	.....	.....	.....	[a] 150
March	.....	[a] 803	[a] 127	.....	[a] 450
April	.....	277	88	473	419
May	.....	373	219	606	399
June	[a] 57	1,500	344	594	624
July	117	148	531	.....	265
August	751	38	531	.....	440
September	624	67	77	.....	256
October	54	102	105	.....	87
November	.....	68	84	.....	76
December	.....	77	.....	.....	77
Mean	.....	.....	.....	.....	[a] 283

[a] Approximate.

BELLE FOURCHE RIVER AT DIVERSION DAM NEAR BELLE FOURCHE, S. DAK.

Samples of water were collected from Belle Fourche River at the diversion dam of the United States Reclamation Service near Belle Fourche, S. Dak., between July 27 and November 13, 1906. A gaging station was established by the United States Geological Survey May 10, 1906, below the diversion dam and inlet canal of Belle Fourche project, United States Reclamation Service. Stream-flow data, including gage heights and estimates of discharge, for that point have been published by the Survey in the following report:

Water-Supply Paper 208, pp. 129–131.

Data from July, 1903, to June, 1906, may be obtained by adding discharge for Belle Fourche and Redwater rivers at Belle Fourche. See the following reports:

Annual Reports United States Reclamation Service: 3, pp. 488–489; 4, p. 325.
Water-Supply Papers: 99, pp. 57–60; 130, pp. 169–175; 172, pp. 156–161; 208, pp. 128–129, 131–132.

Partial analyses, gage heights, and rates of discharge of water and solids for Belle Fourche River at diversion dam near Belle Fourche.

[Drainage area, 4,270 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1906.									
July 27, 29, 30, 31, August 3, 4	0	209	10	26	1,230	1.0	88	6	293
August 7, 8, 9, 10, 11	0	170	3	3,160	814	2.3	550	4,680	1,210
August 16, 17, 18	19	186	5	124	898	1.2	136	46	329
August 19, 20, 21, 22, 23, 24, 25	0	170	10	1,810	898	1.6	259	1,260	628
August 26, 27, 28, 29, 30, 31, September 1	0	219	6	976	862	1.7	280	738	652
September 4, 5, 7, 8	0	211	11	108	894	1.3	156	46	376
September 9, 10, 11, 12, 13, 14, 15	0	.....	.....	292	940	1.4	208	164	528
September 16, 18, 19, 21	7	173	12	120	916	1.6	276	90	683
September 23, 24, 25, 26, 27, 28, 29	0	209	5	100	876	1.5	232	63	548
September 30, October 1, 2, 3, 4, 5, 6	0	203	5	22	916	1.5	213	13	528
October 7, 9, 10, 11, 12	0	222	4	16	904	1.4	201	9	491
October 14, 15, 16, 17, 18, 19	0	224	9	52	910	1.4	208	29	512
October 21, 22, 23, 24, 25, 26, 27, 28, 29, 31	6	150	15	26	978	1.6	258	18	681
November 3	12	187	6	68	880	1.6	250	46	594
November 4, 5, 6, 7, 9, 10	0	216	8	58	870	1.6	247	39	581
November 11, 12, 13	14	183	15	.....	890	1.6	247	.....	594

Relative amount of substances in solution in water from Belle Fourche River at diversion dam near Belle Fourche, S. Dak.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{1}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate radicle (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1906.											
July 27–August 25	21	+3.4	968	18	5.0	5.0	0.00	19	52	1.5	0.01
August 26–September 21	22	+4.1	970	18	4.9	4.8	.00	22	48	1.0	.02
September 23–October 19	25	+3.5	920	20	4.9	2.9	.00	23	48	1.1	.00
October 21–November 13	20	+1.9	894	19	5.4	4.7	.00	24	52	2.0	.25
Mean	.....	3.2	938	19	5.0	4.4	.00	22	50	1.4	.07

Monthly discharge, in second-feet, of Belle Fourche River at diversion dam near Belle Fourche, S. Dak.

Month.	1903.[a]	1904.[a]	1905.[a]	1906.[a]	Mean.
January	.....	.....	.....	.....	[b] 350
February	.....	.....	.....	.....	[b] 350
March	.....	[b] 1,070	[b] 318	.....	694
April	.....	521	288	692	500
May	.....	532	762	939	744
June	[b] 184	2,670	603	711	1,040
July	201	338	1,040	148	432
August	913	126	789	266	524
September	915	248	255	223	410
October	177	346	401	225	287
November	.....	294	529	221	347
December	.....	329	.....	.....	329
Mean	.....	.....	.....	.....	[b] 501

[a] Sum of discharges of Belle Fourche and Redwater Rivers to May, 1906. Values to September, 1905, taken from Fourth Ann. Rept. U. S. Reclamation Service, p. 325.
[b] Approximate.

BIGHORN RIVER NEAR FORT CUSTER, MONT.

Samples of water were collected from Bighorn River at a railroad bridge near Fort Custer, Mont., between June 10, 1905, and June 8, 1906. A gaging station was established at this bridge by the United States Geological Survey June 16, 1904. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for the station have been published by the Survey in the following reports:

Water-Supply Papers: 130, pp. 130–132; 172, pp. 108–110; 208, pp. 96–97; 246, pp. 183–185.

Partial analyses, gage heights, and rates of discharge of water and solids for Bighorn River at railroad bridge near Fort Custer, Mont.

[Drainage area, 20,700 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–6.									
June 10, 11, 12, 13, 14, 15, 16	0	98	21	1,430	196	5.0	19,700	76,100	10,400
June 17, 18, 19, 20, 21, 28, 29	0	93	13	2,790	250	4.7	17,200	130,000	11,600
June 30, July 2, 3, 4, 5, 6, 7, 8	0	92	6	596	200	4.1	13,300	21,400	7,190
July 9, 10, 11, 12, 13	0	90	12	218	202	3.5	10,100	5,950	5,510
August 14, 15, 16, 17, 19	0	111	7	780	312	1.6	3,620	7,630	3,050
August 20, 22, 23, 25, 26	0	120	21	366	324	1.2	2,700	2,670	2,360
August 27, 28, 29, 31, September 1, 2	0	136	18	264	294	1.1	2,480	1,770	1,970
September 24, 25, 26, 27, October 1, 3, 4	7	145	15	2,060	460	0.7	1,700	9,460	2,110
October 5, 6, 8, 9, 10, 11, 14	9	144	18	1,710	492	0.9	1,980	9,150	2,630
October 15, 17, 20, 22, 23, 28	2	181	18	324	512	0.9	2,130	1,870	2,950
October 29, 30, 31, November 1, 2, 3, 4	9	164	20	1,220	446	0.8	1,850	6,100	2,230
November 5, 6, 7, 8, 9, 10, 11	13	174	16	76	540	0.8	1,980	407	2,890
November 12, 13, 14, 15, 16, 17, 18	0	198	18	18	536	0.7	1,700	83	2,460
December 12, 13, 14, 15, 19, 20, 21	0	261	28	24	678	1.3	2,900	188	5,310
December 24, 25, 27, 28, 29, 30	0	245	25	134	654	1.1	2,400	870	4,240
December 31, January 1, 2, 3	0	277	29	14	710	3.2	2,100	79	4,020
January 7, 8, 9, 11, 12	16	228	29	24	670	3.5	3,300	214	5,970
January 15, 22, 23, 24, 25	0	214	29	82	632	3.7	4,000	886	6,830
January 28, 29, 30, 31, February 1, 2, 6	0	219	22	36	602	3.9	4,400	428	7,160
February 7, 8, 9, 12, 13, 14, 15	0	231	21	160	544	3.8	4,200	1,810	6,170
February 16, March 2, 3	0	182	25	84	588	4.0	4,900	1,110	7,780
March 4, 5, 7, 8, 9, 10	0	166	23	814	520	3.7	4,100	9,020	5,760
April 4, 5, 6, 7	0	140	24	2,450	480	3.6	3,640	24,100	4,720
April 8, 9, 10, 11, 12, 13, 14	0	166	20	930	522	3.4	3,210	8,050	4,520
April 15, 16	0	239	14	994	498	3.3	3,020	8,100	4,060
May 18, 19	0	96	5	1,060	206	5.0	8,300	23,800	4,620
May 20, 21, 22, 23, 24, 25, 26	6	179	5	1,470	196	5.3	9,860	39,000	5,220
May 27, 28, 29, 30	21	43	5	2,860	202	6.5	15,900	123,000	8,670
May 30, 31, June 1, 2, 3	26	19	10	1,560	190	6.0	12,800	53,900	6,560
June 3, 4, 5, 6, 7, 8	0	108	10	1,180	240	5.5	10,200	32,300	6,600

Relative amount of substances in solution in water from Bighorn River at railroad bridge near Fort Custer, Mont.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905–6.											
June 10–July 13	27	+4.7	178	17	4.7	a13	0.00	58	25	4.8	0.05
August 14–October 1	23	+3.0	354	17	5.1	14	.00	39	42	5.4	.04
October 5–November 11	27	.....	501	14	5.0	10	.00	38	.....	5.8	.04
November 12–January 3	24	−4.1	632	15	4.9	8.5	.00	39	44	4.1	.03
January 7–February 15	24	−5.8	586	15	5.3	8.4	.00	35	41	9.9	.01
February 16–April 14	20	.....	474	17	5.3	11	.00	.....	45	2.0	.04
April 15–May 30	15	+8.6	229	18	6.1	11	.00	46	34	4.3	.02
May 30–June 8	11	+1.7	210	14	4.8	11	.00	49	30	4.2	.01
Mean	.....	4.6	396	16	5.2	11	.00	43	37	5.1	.03

a Sodium is 90 per cent and potassium is 13 per cent of this amount.

Monthly discharge, in second-feet, of Bighorn River near Fort Custer, Mont.

Month.	1904.	1905.	1906.	1907.	1908.	Mean.
January	.....	[a] 1,480	.....	.....	.....	[a] 1,480
February	.....	.....	.....	.....	.....	[a] 1,600
March	.....	[a] 1,960	[b] 10,500	.....	[c] 1,720	[a] 2,000
April	.....	1,440	3,800	2,380	2,740	2,590
May	.....	4,320	8,720	8,660	5,620	6,580
June	[d] 20,700	17,400	13,600	16,700	22,600	18,200
July	12,300	9,140	11,000	22,300	14,600	13,900
August	4,580	3,490	6,290	7,770	6,230	5,670
September	2,450	[a] 2,080	3,070	2,900	2,770	2,650
October	1,730	2,200	1,640	2,150	2,850	2,110
November	1,560	1,730	1,690	1,700	1,930	1,720
December	.....	.....	.....	.....	.....	[a] 1,500
Mean	.....	.....	.....	.....	.....	5,000

[a] Approximate. [b] March 26–31. [c] March 21–31. [d] June 16–30.

BOISE RIVER NEAR BOISE, IDAHO.

Samples of water were collected from Boise River at Highland, near Boise, Idaho, between May 26, 1905, and April 30, 1907. A gaging station was established by the United States Geological Survey 9 miles above Boise December 15, 1894, and was removed to Highland, 8 miles upstream, in 1905. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for those points have been published by the Survey in the following reports:[a]

Annual Reports: 18, IV, pp. 340–344; 19, IV, pp. 452–454; 20, IV, p. 62, 483; 21, IV, pp. 411–412; 22, IV, 431–432.

Bulletins: 131, p. 66; 140, p. 236.

Water-Supply Papers: 11, p. 81; 16, p. 168; 28, pp. 155, 161, 168–169; 38, pp. 356–357; 39, p. 453; 51, pp. 427–428; 52, p. 522; 66, pp. 128, 176; 85, pp. 207–209; 100, pp. 436–439; 135, pp. 199–202; 178, pp. 121–123; 214, pp. 93–94; 252, pp. 245–248.

[a] See also Second Ann. Rept. U. S. Reclamation Service, p. 316.

Partial analyses, gage heights, and rates of discharge of water and solids for Boise River at Highland, near Boise, Idaho.

[Drainage area, 2,610 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–1907.									
May 26	.....	.....	.....	204	136	6.4	3,430	1,890	1,260
July 19	.....	.....	.....	0	122	3.7	970	0	320
July 28	.....	.....	.....	0	106	3.6	910	0	260
June 27, 28, 29, 30	0	41	10	130	56	8.0	5,120	1,800	774
July 1, 2, 3, 4, 5, 6, 7	12	22	5	66	66	7.5	4,290	763	763
July 8, 9, 10, 11, 12, 13, 14	0	42	5	52	72	6.6	3,300	463	641
July 15, 16, 17, 18, 19, 21	38	13	5	26	90	5.5	2,120	149	516
July 22, 23, 24, 25, 26, 27, 28	25	32	5	60	66	4.5	1,440	233	257
July 29, 30, August 1, 2, 3, 4	0	59	10	0	106	3.9	1,150	0	329
August 5, 6, 7, 8, 9, 10, 11	16	36	5	46	94	3.6	874	109	222
August 12, 13, 14, 15, 16, 17, 18	0	72	5	16	88	3.4	777	34	185
August 19, 20, 21, 22, 23, 24, 25	0	65	12	8	80	3.4	796	17	172
August 26, 27, 28, 29, 30, September 1	0	60	5	30	50	3.4	766	62	103
September 2, 3, 5, 6, 8	0	71	8	12	54	3.3	721	23	105
September 8, 10, 12, 13, 15	0	58	11	8	104	3.3	711	15	200
September 16, 19, 20, 22	0	68	5	2	96	3.2	669	4	173
September 24, 25, 26, 27, 28, 29	0	77	4	4	94	3.2	625	7	159
October 1, 2, 3, 4, 5, 6	0	67	4	24	50	3.2	662	43	89
October 8, 9, 10, 11, 12, 13	0	71	3	48	78	3.2	650	84	137
October 15, 16, 17, 18, 19, 20	0	63	5	30	66	3.3	688	56	123
October 21, 22, 23, 24, 25, 26, 27, 28	0	71	5	30	68	3.3	700	57	129
October 29, 30, 31, November 1, 2, 3	0	31	.....	18	48	3.4	738	36	96
November 5, 6, 7, 9	0	45	13	16	38	3.5	804	35	83
November 12, 13, 14, 15, 16, 17	0	51	7	68	70	5.4	2,360	433	446
November 19, 20, 21, 22, 23, 24	0	50	5	38	52	3.9	1,140	117	160
November 26, 27, 28, 30, December 1	0	74	7	16	60	3.6	880	38	143
December 3, 4, 5, 6, 7, 8	0	59	6	82	66	.....	.....	.....	.....
December 10, 11, 12, 13, 14, 15	0	56	13	72	30	.....	.....	.....	.....
December 17, 18, 19, 20, 21, 22	0	58	4	10	122	.....	.....	.....	.....
December 24, 26, 27, 28, 29	0	58	2	18	124	.....	.....	.....	.....
December 31, January 1	0	59	4	68	66	.....	.....	.....	.....
January 7, 8, 9, 10, 11, 12	0	57	7	74	72	.....	.....	.....	.....
January 14, 15, 16, 17, 18, 19	0	44	2	14	92	.....	.....	.....	.....
January 21, 22, 23, 24, 25, 26	0	60	9	44	64	.....	.....	.....	.....
January 28, 29, 30, 31, February 1, 2	0	56	5	0	72	.....	.....	.....	.....
February 5, 6, 7, 8, 9	0	41	5	300	74	6.8	3,540	2,870	708
February 11, 12, 13, 14, 15, 16	0	43	5	6	80	6.3	2,920	47	630
February 18, 19, 20, 21, 23	0	48	5	40	76	6.2	2,890	312	593
February 24, 25, 26, 27, March 1, 2	0	48	5	60	80	6.7	3,410	552	737
March 4, 5, 6, 7, 8, 9	0	48	8	60	74	7.1	3,960	641	791
March 11, 12, 13, 14, 15	0	52	5	50	100	7.0	3,750	505	1,010
March 16, 17, 18, 20, 21, 22, 23	0	38	5	248	100	9.6	7,740	5,180	2,090
March 25, 26, 27, 28, 29, 30	0	40	13	92	128	8.8	6,370	1,580	2,200
April 1, 2, 3, 4, 5, 6	0	43	10	134	90	9.2	6,970	2,520	1,690
April 8, 9, 10, 11, 12, 13	0	38	5	182	84	11.2	11,400	5,600	2,580
April 15, 16, 17, 18, 19, 20, 22	0	43	.....	114	96	12.1	13,700	4,220	3,550
April 23, 24, 25, 26, 27, 29, 30	0	43	5	62	100	11.2	12,000	2,010	3,240

Relative amount of substances in solution in water from Boise River at Highland, near Boise, Idaho.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles (in per cent of dissolved solids).							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium (Na+K).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3)
1906–7.											
June 27–July 21	24	.....	78	.....	4.2	14	0.00	67	8.7	13	0.00
July 22–August 18	27	.....	104	15	3.1	14	.00	69	.....	4.8	.00
August 19–September 15	23	+15.3	92	18	5.6	20	.00	75	11	7.9	.24
September 16–October 13	22	.....	110	.....	4.1	19	.00	65	13	4.5	.01
October 15–November 9	24	+16.3	98	20	4.6	19	.00	53	16	10	.00
November 12–December 8	23	+17.2	84	24	6.4	14	.00	64	20	6.1	.00
December 10–29	17	.....	108	18	2.8	19	.00	.....	16	4.7	.00
January 7–February 2	24	.....	104	18	3.6	.....	.00	.....	15	7.4	.21
February 5–March 2	22	+17.2	90	18	4.0	16	.00	53	11	5.8	.49
March 4–30	24	.....	114	19	3.2	16	.00	.....	14	4.6	T.
April 1–30	26	.....	88	19	4.0	16	.00	.....	12	7.8	.....
Mean	.....	16.5	97	19	4.1	17	.00	64	14	7.0	.10

Monthly discharge, in second-feet, of Boise River near Boise, Idaho.

Month.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.
January	1,270	1,180	818	550	2,590	2,080	1,280	989
February	1,230	1,130	954	1,210	1,410	1,810	1,760	1,620
March	1,660	2,480	1,420	1,920	1,840	4,900	2,890	1,430
April	3,940	4,750	[a] 8,100	4,200	7,100	6,340	5,060	3,560
May	6,030	8,090	[b] 21,100	5,220	9,810	8,240	10,100	5,700
June	3,770	22,200	7,600	4,990	12,200	4,990	4,790	4,790
July	2,460	5,530	2,310	1,880	5,740	1,450	1,880	1,720
August	1,030	1,320	1,090	737	1,770	793	846	798
September	967	951	1,040	652	1,150	769	833	682
October	916	875	1,020	859	1,350	1,060	910	735
November	916	[c] 900	1,080	935	1,500	1,080	933	907
December	797	[c] 850	[c] 1,000	2,450	1,570	1,100	1,230	1,020
The year	2,080	4,190	3,960	2,130	4,000	2,880	2,710	2,000

Month.	1903.	1904.	1905.	1906.	1907.	1908.	Mean.
January	1,320	.....	.....	820	.....	1,080	1,270
February	1,140	.....	.....	1,020	[c] 3,150	1,080	1,460
March	2,310	4,260	[d] 1,770	1,630	5,580	2,280	2,600
April	7,470	11,200	2,940	5,630	11,200	6,380	6,280
May	8,400	13,400	3,710	6,900	11,000	5,970	8,830
June	10,000	8,690	4,120	8,780	8,910	5,410	7,940
July	2,380	3,260	1,270	2,630	5,410	3,200	2,940
August	854	1,160	643	839	1,640	1,050	1,040
September	772	730	578	685	1,030	925	840
October	943	951	693	683	932	1,100	930
November	[c] 1,130	.....	684	1,220	933	988	1,020
December	[c] 928	.....	652	.....	1,030	943	1,130
The year	3,010	.....	.....	.....	.....	2,530	3,020

[a] April 1–19. [b] May 12–31. [c] Approximate. [d] March 18–31.

NOTE.—Gaging station removed 8 miles upstream to Highland early in 1905.

CARSON RIVER NEAR HAZEN, NEV.

Samples of water were collected from Carson River at the diversion dam of the United States Reclamation Service near Hazen, Nev., between April 10, 1906, and April 15, 1907. This dam is below the outlet of the canal carrying water from Truckee River to Carson River, and the samples taken during August, September, and Octo-

ber, 1906, represent a mixture of the waters of Truckee and Carson Rivers. The nearest gaging station of the United States Geological Survey is at Empire, Nev., about 60 miles above the diversion dam. The drainage area at Empire is 988 square miles and at the diversion dam is 1,700 square miles, but the flow is approximately the same at both places. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for the station at Empire have been published by the Survey in the following reports:[a]

Annual Report: 12, II, pp. 324–325.
Bulletin: 140, pp. 212–213.
Water-Supply Papers: 51, p. 401; 66, pp. 110–111, 175; 75, p. 189; 85, pp. 109–111; 100, pp. 175–177; 133, pp. 337–339; 176, pp. 111–113; 212, pp. 79–81; 250, p. 128.

Partial analyses of water from Carson River at diversion dam near Hazen, Nev.

[Drainage area, 1,700 square miles.]

Dates.	Analysis (milligrams per liter).				
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).
1906–7.					
April 10	0	102	10	150	196
April 21	0	73	5	546	150
April 28	0	70	10	142	122
May 9	0	70	5	352	120
May 15	0	67	5	184	154
May 21	0	61	5	206	108
May 28	0	64	5	120	104
June 4	0	68	5	154	142
June 11	0	64	5	170	144
June 18	0	48	5	154	114
June 25	0	64	5	122	136
July 2	0	52	5	130	114
July 9	0	64	10	118	118
July 16	0	51	10	174	94
July 23	6	51	5	56	130
July 28	0	65	5	954	150
August 7	6	62	10	108	156
August 20	0	102	10	234	216
August 28	0	111	18	94	184
September 3	0	116	17	84	188
September 10	0	103	15	70	170
September 19	0	112	11	24	224
September 24	0	107	10	20	198
October 1	0	113	11	4	226
October 8	0	78	10	40	202
October 14	0	124	13	64	284
October 22	0	126	14	36	250
October 29	0	114	16	40	290
November 5	0	125	16	98	244
November 12	0	116	14	186	224
November 19	0	112	14	118	250
November 26	0	110	16	10	258
December 3	0	115	14	226	246
December 10	0	122	16	992	276
December 17	0	119	13	116	254
January 7	0	125	14	84	204
January 14	0	114	16	76	230
January 21	0	120	14	82	208
January 28	0	113	15	14	240
February 4	0	108	15	368	206
February 11	0	88	8	54	186
February 18	0	88	10	74	158
February 24	0	86	13	12	170
February 25	0	98	10	28	200
March 11	0	105	16	144	180
April 15	0	74	10	382	160

NOTE.—Nearest gaging station is at Empire, Nev.; drainage area, 988 square miles. During August, September, and October half or a less part of the discharge of Carson River at the sampling station was water from Truckee River.

[a] See also Second Ann. Rept. U. S. Reclamation Service, p. 359; Third Ann. Rept. U. S. Reclamation Service, p. 348.

Relative amount of substances in solution in water from Carson River at diversion dam near Hazen, Nev.

Dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{1}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1906–7.											
April 10, 21, 28, May 9	4	+10.7	159	20	3.6	14	0.00	57	21	6.9	0.06
May 15, 28, June 4, 11	4	+ 5.9	130	16	6.2	14	.00	68	22	5.3	.00
May 21, June 18; 25, July 2	4	.....	132	19	4.5	14	.00	50	.....	4.5	.....
July 9, 16, 23, August 7	4	+14.7	116	18	4.1	19	.00	56	16	8.5	.00
July 28, August 20, 28, September 3	4	.....	176	18	5.3	.....	.00	56	23	5.6	.01
September 10, 19, 24, October 1	4	.....	208	16	.....	17	.00	53	25	5.8	.06
October 8, 14, 22, 29	4	+ 3.8	276	14	4.3	14	.00	45	30	7.2	.00
November 5, 12, 19, 26	4	+ 6.4	264	15	3.7	15	.00	45	27	6.1	.01
December 3, 10, 17	3	.....	268	14	3.2	.....	.00	44	28	5.6	.08
January 7, 28	4	+ 3.8	258	14	3.6	14	.00	44	29	5.8	.07
February 4, 11, 18, 25	4	.....	194	15	4.9	.....	.00	47	24	6.7	.23
February 24, March 11, April 15	3	.....	208	17	4.2	16	.00	.....	27	6.7	.....
Mean	.....	7.6	199	16	4.3	15	.00	51	25	6.2	.05

Monthly discharge, in second-feet, of Carson River near Empire, Nev.

Month.	1890.	1895.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	Mean.
January	.....	.....	.....	115	225	264	187	267	477	443	290	284
February	.....	.....	.....	645	280	378	792	300	298	717	257	458
March	.....	.....	.....	634	410	308	1,040	366	452	[a] 791	323	540
April	1,560	.....	.....	700	618	681	1,090	561	914	.....	475	825
May	3,480	.....	.....	2,000	1,040	1,320	2,010	929	1,940	.....	579	1,660
June	3,140	.....	.....	1,420	1,000	1,410	1,850	728	2,240	[b] 2,270	433	1,610
July	2,160	802	.....	468	170	279	638	95	1,860	2,910	112	949
August	756	149	.....	126	19	20	139	7	418	569	47	225
September	144	192	.....	39	15	15	82	6	101	223	62	88
October	.....	154	70	113	54	49	420	46	172	205	104	139
November	.....	304	109	197	160	221	267	78	262	244	133	198
December	.....	211	93	311	214	203	229	135	436	318	132	228
The year	.....	.....	.....	563	351	429	728	293	798	.....	246	600

[a] Approximate.
[b] From June, 1907, to March, 1908, the estimated flow of the river has been increased by 30 second-feet as a correction for the power-canal diversion. After the latter date the correction has been the measured flow of the canal.

COLORADO RIVER NEAR YUMA, ARIZ.

Samples of water were collected from Colorado River at the railroad bridge near Yuma, Ariz., between January 1 and December 30, 1905. A gaging station was established at the bridge by the Southern Pacific Company during the summer of 1876, and records of river height have been maintained since April 1, 1878. Stream-flow data, including gage heights, rating tables, and estimates of dis-

charge, for this station have been published by the Survey in the following reports:[a]

Annual Reports: 12, II, p. 290; 18, IV, pp. 298–299.
Bulletins: 131, pp. 51–52; 140, pp. 207–210.
Water-Supply Papers: 11, p. 73; 16, p. 151; 28, pp. 133, 141; 38, pp. 324–325; 50, p. 387; 66, p. 104; 81, pp. 69–71; 85, pp. 17–20; 100, pp. 19–25; 133, pp. 25–32; 177, pp. 13–16, 213, pp. 26–29; 249, pp. 41–46.

The results of other investigations of the quality of the Colorado River water at Yuma are reported as follows:

University of Arizona Agricultural Experiment Station: Bull. 44, The river irrigating waters of Arizona, by R. H. Forbes, 1902; Bull. 53, Irrigating sediments and their effects upon crops, by R. H. Forbes, 1906.
Third Annual Report United States Reclamation Service.

Partial analyses, gage heights, and rates of discharge of water and solids for Colorado River at railroad bridge near Yuma, Ariz.

[Drainage area, 225,000 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905.									
January 1, 2, 3	0	235	191	741	1,020	18.5	3,750	7,500	10,300
January 4, 5, 6	6	196	203	900	1,040	18.8	4,430	10,800	12,400
January 7, 8, 9	0	213	224	889	1,090	18.8	4,680	11,200	13,700
January 10, 11, 12	0	222	153	8,160	758	19.8	9,600	211,000	19,600
January 18, 19, 20	0	211	217	4,380	880	22.3	29,600	350,000	70,400
January 21, 23, 25	0	229	261	2,400	1,110	20.2	8,060	52,000	24,200
January 26, 27, 28	0	267	274	1,820	1,140	19.3	6,250	30,800	19,200
January 29, 30, 31	0	247	293	1,320	1,220	19.4	5,120	18,300	16,900
February 2, 3, 4	0	318	254	3,680	1,180	19.7	6,400	63,600	20,400
February 6	0	254	203	14,900	1,010	21.2	16,600	670,000	45,500
February 8, 9, 10	18	222	118	11,400	602	27.8	65,800	2,010,000	107,000
February 11	0	251	170	9,770	784	24.1	37,300	985,000	78,800
February 14, 15, 16	0	233	182	6,420	836	22.0	21,000	364,000	47,400
February 20, 21, 22	0	272	174	16,800	758	25.8	52,000	2,360,000	106,000
February 23, 24, 25	0	280	255	23,800	1,050	22.3	24,600	1,580,000	69,500
February 26, 27, 28	0	243	176	17,300	766	23.6	27,700	1,300,000	57,300
March 1, 2, 3	0	318	152	18,100	724	25.2	46,200	2,260,000	90,300
March 4, 5, 6	3	256	180	22,400	768	25.6	55,200	3,340,000	115,000
March 7, 8, 9	0	278	175	26,500	844	24.5	41,200	2,950,000	94,000
March 10, 11, 12	0	278	188	30,800	858	24.2	38,300	3,190,000	88,600
March 13, 14, 15	0	262	173	30,400	812	24.1	35,900	2,940,000	78,700
March 16, 17, 18	0	317	125	24,300	660	26.8	63,000	4,130,000	112,000
March 19, 20, 21	0	326	144	23,700	676	29.4	95,900	6,130,000	175,000
March 22, 23, 24	0	286	161	30,600	750	27.4	75,600	6,250,000	153,000
March 25, 26, 27	0	272	156	25,400	754	23.5	36,200	2,480,000	73,600
March 28, 29, 30	0	248	130	21,100	684	22.4	26,900	153,000	49,600
March 31, April 1, 2	0	249	126	16,400	688	21.6	21,400	94,500	39,700
April 3, 4, 5	0	269	132	14,400	696	21.4	20,000	77,500	37,600
April 6, 7, 8	0	304	126	25,400	704	22.4	28,600	1,960,000	54,300
April 9, 10, 11	0	231	128	17,200	680	22.0	24,200	1,120,000	44,400
April 12, 13, 14	0	278	117	26,500	612	25.6	55,200	3,950,000	91,200
April 15, 16, 17	0	246	114	24,900	572	27.2	70,900	4,770,000	109,000
April 18, 19, 20	0	235	106	17,900	612	24.6	44,000	2,130,000	72,700
April 23, 24, 25	0	245	99	17,400	648	22.5	32,900	1,540,000	57,600
April 26, 27, 28	0	244	98	18,400	586	23.8	39,300	1,950,000	62,200
April 29, 30, May 1	0	222	91	17,100	578	24.5	38,400	1,770,000	59,800
May 2, 3, 4	0	243	81	24,400	578	24.6	38,900	2,570,000	60,600
May 5, 6, 7	10	214	81	27,200	582	24.5	37,500	2,750,000	58,900

[a] See also Second Ann. Rept. U. S. Reclamation Service, pp. 140–141, 145–146.

Partial analyses, gage heights, and rates of discharge of water and solids for Colorado River at railroad bridge near Yuma, Ariz.—Continued.

Dates.	Analysis (milligrams per liter.)					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905.									
May 8, 9, 10	0	200	76	16,600	496	25.6	45,100	2,030,000	60,500
May 11, 12, 13	0	210	69	14,700	490	26.0	46,300	1,830,000	61,200
May 14, 15, 16	0	209	59	12,600	478	25.0	37,500	1,280,000	48,300
May 17, 18, 19	0	205	60	12,400	468	24.7	35,000	1,170,000	44,200
May 20, 21, 22	0	223	60	9,860	474	24.5	35,800	953,000	45,800
May 23, 24, 25	0	178	60	9,340	422	25.2	41,200	1,040,000	47,000
May 26, 27, 28	0	181	62	8,010	658	26.0	48,000	1,040,000	85,200
May 29, 30, 31	0	181	50	6,650	456	27.1	56,700	1,020,000	69,800
June 1, 2, 3	0	181	48	4,430	424	27.8	65,000	777,000	74,500
June 4, 5, 6	0	173	37	5,100	390	28.3	67,700	933,000	71,300
June 7, 8, 9	0	158	36	5,270	360	28.4	70,900	1,010,000	69,000
June 10, 11, 12	0	160	37	4,500	360	28.2	71,100	862,000	69,100
June 13, 14, 15	0	180	42	2,780	416	28.6	80,000	600,000	89,800
June 16, 17, 18	0	167	34	2,910	360	28.8	85,800	673,000	83,800
June 19, 20, 21	0	161	41	2,190	354	29.1	92,700	548,000	88,600
June 22, 23, 24	0	156	24	1,610	374	29.0	89,000	387,000	89,800
June 25, 26, 27	0	175	31	3,880	394	28.5	77,700	813,000	82,600
June 28, 29, 30	0	162	31	3,530	408	27.6	64,800	617,000	71,500
July 1, 2, 3	8	145	39	3,690	340	26.4	54,600	543,000	50,100
July 4, 5, 6	0	177	38	4,750	348	25.3	44,100	566,000	41,500
July 11, 13	0	142	38	3,320	308	22.4	31,500	282,000	26,200
July 14, 15, 16	5	136	40	2,780	314	22.0	28,500	214,000	24,200
July 17, 18, 19	0	162	65	3,510	482	21.8	26,200	248,000	34,100
July 20, 21, 22	0	216	79	2,240	504	21.0	21,900	132,000	29,800
July 23, 24, 26	6	154	56	2,610	432	20.4	20,700	146,000	24,100
July 27, 28, 29	0	152	59	2,440	424	20.1	18,600	123,000	21,300
July 30, 31, August 1	0	142	61	3,390	394	20.0	16,900	154,000	18,000
August 4, 5, 6	0	158	74	2,140	392	19.8	14,600	84,500	15,500
August 7, 8, 9	15	121	76	2,700	464	20.4	16,700	122,000	20,900
August 10, 11, 12	9	155	83	4,080	506	20.4	16,700	184,000	22,800
August 13, 14, 15	0	177	80	6,980	542	20.0	15,500	292,000	22,700
August 16, 17, 18	5	157	90	9,090	710	19.4	12,000	294,000	23,000
August 19, 20, 21	0	192	99	3,750	582	19.0	9,260	93,800	14,600
August 22, 23, 24	0	197	92	1,760	604	18.8	7,820	37,200	12,700
August 25, 26, 27	0	187	88	1,810	566	18.7	7,290	35,700	11,100
August 28, 29, 30	0	188	89	2,150	598	19.0	8,050	46,700	13,000
August 31, September 1, 2	0	218	143	2,560	830	18.6	6,740	46,700	15,100
September 3, 4, 5	0	181	140	2,170	878	18.4	6,290	36,800	14,900
September 6, 7, 8, 9	0	214	133	2,350	824	18.3	5,580	35,400	12,400
September 11, 12, 13	0	198	152	3,440	932	18.7	7,410	68,700	18,700
September 15, 16, 17	0	180	134	4,130	830	18.9	7,870	87,600	17,600
September 20, 21, 22	0	223	139	7,280	936	18.6	6,640	131,000	16,800
September 24, 25, 26	0	260	143	1,230	990	18.3	5,630	187,000	15,100
September 27, 28, 29	0	223	153	8,990	1,100	18.0	5,280	128,000	15,700
September 30, October 1, 2	0	242	157	5,550	962	18.0	5,240	78,500	13,600
October 3, 5	0	210	177	4,660	964	18.0	7,200	90,500	18,700
October 6, 7 8	0	216	186	7,620	1,230	18.7	11,300	233,000	37,400
October 11, 12, 13	0	232	155	13,600	1,090	19.9	11,900	438,000	35,100
October 14, 18, 19	0	202	147	7,230	866	18.9	7,610	149,000	17,800
October 16, 17, 18	0	257	137	12,900	1,020	18.9	7,580	263,000	20,800
October 19, 20, 21	0	224	137	9,170	986	18.7	6,630	164,000	17,700
October 22, 23, 24	0	231	120	8,760	968	18.6	6,040	143,000	15,800
October 26, 27, 28	0	238	127	8,240	1,030	18.4	5,550	124,000	15,400
October 29, 30, 31, November 2	0	205	137	6,710	880	18.4	5,610	102,000	13,300
November 4, 6, 7	6	218	151	3,300	932	18.4	5,770	51,500	14,500
November 9, 13. 14	0	211	158	2,980	892	18.7	6,330	51,000	15,300
November 15, 16, 17	0	238	194	2,680	1,040	18.8	6,640	48,100	18,700
November 18. 19, 20	0	201	180	1,950	892	18.9	6,370	33,600	15,400
November 22, 23, 25	0	191	180	1,510	850	18.8	6,480	26,300	14,900
November 27, 29, 30	0	211	141	12,300	632	25.5	57,300	1,900,000	97,800
December 1, 2	0	274	169	24,200	828	26.0	57,300	730,000	128,000
December 4, 5, 8	0	231	141	21,700	1,000	21.2	26,900	1,580,000	72,700
December 9, 11, 12	0	228	148	14,200	896	18.8	12,700	488,000	30,800
December 13, 14, 15	0	224	155	10,600	870	18.3	9,640	276,000	22,700
December 16, 18, 19	0	228	181	9,330	920	18.0	8,120	205,000	20,200
December 20, 21, 22	0	233	198	7,450	938	17.9	7,680	154,000	19,400
December 23, 25, 26	0	242	218	5,800	948	17.9	7,550	118,000	19,300
December 27, 28, 30	0	247	200	4,120	1,070	17.8	6,630	73,800	19,200

Relative amount of substances in solution in water from Colorado River at railroad bridge near Yuma, Ariz.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{1}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905.											
January 1–31	24	−0.1	994	11	3.5	18	0.00	23	27	24	0.13
February 2–28	20	+2.2	816	11	3.2	21	.00	32	21	24	.04
March 1–April 2	33	+1.2	686	10	2.9	20	1.9	36	20	22	.05
April 3–May 1	27	− .9	609	11	3.0	19	1.4	38	22	19	.04
May 2–31	30	+1.9	488	14	3.3	16	.00	43	25	14	.06
June 1–30	30	+ .7	345	16	3.8	13	.00	50	26	11	.26
July 1–August 1	18	.....	395	.....	3.5	11	.00	.....	23	15	.28
August 4–30	27	.....	532	14	.....	15	.00	.....	30	16	.10
August 31–September 29	25	.....	930	15	3.7	13	.00	.....	33	15	.03
September 30–November 2	29	+4.4	972	13	3.1	16	.00	23	33	14	.....
November 4–30	18	+2.3	870	13	3.1	17	.00	25	31	19	.07
December 1–30	23	−2.1	848	11	2.8	18	.00	28	27	22	.03
Mean	.....	1.8	707	13	3.3	16	.28	33	26	18	.10

Monthly discharge, in second-feet, of Colorado River near Yuma, Ariz.

Month.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	Mean.
January	3,730	3,090	3,640	8,130	6,870	21,500	6,320	7,610
February	3,960	3,370	3,800	28,100	9,560	18,800	14,200	11,700
March	4,900	6,120	5,980	50,500	25,400	24,100	16,100	19,000
April	6,180	14,300	8,060	37,800	32,500	35,300	17,800	21,700
May	36,000	33,700	27,700	42,200	54,100	37,900	27,200	37,000
June	42,500	53,100	43,800	76,500	84,200	94,800	42,900	62,500
July	12,500	37,500	23,000	30,300	39,000	96,500	32,600	38,800
August	4,180	10,900	17,100	12,100	19,200	37,600	24,300	17,900
September	3,820	6,790	11,600	6,500	11,700	23,200	11,400	10,700
October	4,300	8,480	11,600	8,040	11,700	13,600	9,510	9,600
November	4,190	5,400	6,150	12,000	9,710	10,800	8,090	8,050
December	5,410	4,340	4,480	15,400	18,300	7,450	15,900	10,200
The year	11,000	15,600	13,900	27,300	26,900	35,100	18,900	21,200

ELM FORK OF RED RIVER NEAR MANGUM, OKLA.

Samples of water were collected from Elm Fork of Red River at a highway bridge near Mangum, Okla., between April 13, 1905, and March 22, 1907. A gaging station was established at the bridge by the United States Geological Survey April 12, 1905, and discontinued March 31, 1908. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for this station have been published by the Survey in the following reports:

Water-Supply Papers: 173, pp. 79–81; 209, pp. 57–59; 247, pp. 97–100.

Partial analyses, gage heights, and rates of discharge of water and solids for Elm Fork of Red River at highway bridge near Mangum, Okla.

[Drainage area, 750 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–1907.									
April 13, 15, 16, 17, 18	7	146	9,010	994	18,500	2.0	17	46	851
April 26				5,550	2,540	3.6	500	7,480	3,430
May 23				3,780	3,010	2.9	195	1,990	1,580
May 17, 18, 20, 21, 22, June 2, 3	10	113	2,080	4,910	5,770	3.0	652	8,640	10,100
June 5, 7, 8, 9, 10	0	135	1,510	1,410	4,650	4.0	888	3,380	11,200
June 11, 12, 13, 14, 15	0	148	2,970	218	7,830	2.9	161	95	3,410
June 18, 19, 20, 21, 22, 23, 24	0	122	3,090	1,880	8,080	3.3	484	2,460	10,600
June 25, 26, 27, 28, 29, 30, July 1	0	128	2,550	232	7,250	2.7	105	66	2,050
July 2, 3, 4, 5, 6, 7	0	148	4,650	192	10,700	2.6	46	24	1,330
July 9, 10, 11, 12, 13, 14, 15	0	126	5,410	1,000	11,800	2.6	47	127	1,500
July 16, 17, 23, 25, 26, 27, 28	0	116	3,070	178	7,290	2.7	96	46	1,890
July 25				272	4,050	3.2	350	257	3,830
November 1, 2, 3, 4	0	145	9,320	298	19,000	2.3	18	14	920
November 5, 6, 7, 8, 9, 10, 11	0	106	4,050	1,330	8,820	3.2	341	1,220	8,130
November 12, 13, 14, 15, 16, 17, 18	0	123	3,380	432	7,920	2.4	31	36	662
November 19, 20, 21, 22, 23, 24, 25	0	132	4,480	2,100	9,980	2.8	223	1,270	6,010
November 26, 27, 28, 29, 30, December 1, 2	0	115	3,400	362	8,200	2.4	53	52	1,180
November 29, 30, December 5, 6, 7, 8, 9	0	139	5,400	472	11,500	2.3	42	53	1,300
December 10	0	99	5,950	1,660	12,900	2.3	41	184	1,430
December 12	0	132	6,210	1,670	13,300	2.3	41	184	1,470
December 13	0	132	5,010	396	12,800	2.9	120	128	4,140
December 14	0	66	3,130	1,010	6,970	2.8	90	246	1,690
December 15	0	116	3,500	4	8,080	2.5	23	0	500
December 16	0	92	5,670	4,150	8,010	2.5	20	224	433
December 17	0	119	5,480	852	11,800	2.4	20	46	637
December 19	0	145	5,210	32	11,700	2.4	20	2	632
December 20	0	131	4,640	800	10,500	2.4	20	43	568
December 21	0	128	5,110	1,180	11,300	2.4	20	64	608
December 22	0	140	5,670	236	12,400	2.4	20	13	670
December 23	0	110	5,820	480	12,700	2.5	23	30	786
December 24	0	146	5,680	1,360	10,700	2.5	23	84	665
December 25	0	145	6,150	0	13,100	2.5	20	0	708
December 26	0	162	6,420	552	13,000	2.4	20	30	708
December 27	0	162	6,620	468	13,900	2.4	20	25	747
December 28	0	166	6,590	4	13,900	2.4	20	0	749
December 29	0	162	6,610	340	13,000	2.4	20	18	699
December 30	0	163	6,110	168	13,200	2.4	20	9	710
December 31	0	166	6,540	668	13,500	2.4	20	35	731
January 1	0	139	6,260	408	13,600	2.4	25	28	915
January 2	0	145	6,240	628	13,100	2.4	25	42	885
January 3	0	152	6,480	296	13,600	2.4	25	20	915
January 4	0	165	6,000	260	12,700	2.4	25	18	859
January 5	0	158	6,070	12	13,100	2.4	25	1	885
January 6	0	158	6,220	24	13,200	2.4	25	2	887
January 7	0	158	6,660	324	13,900	2.4	25	22	940
January 8	0	165	7,010	304	14,600	2.3	21	17	827
January 9	0	172	6,940	436	14,600	2.3	21	25	830
January 10	0	152	6,260	216	13,300	2.3	21	12	756
January 11	0	158	6,580	92	13,800	2.3	21	5	780
January 12	0	152	6,750	296	14,200	2.4	25	20	960
January 13	0	152	7,000	92	14,500	2.4	25	6	980
January 14	0	152	7,000	216	14,400	2.3	21	12	812
January 15	39	119	7,000	180	14,800	2.3	21	10	840
January 16	13	132	7,510	352	15,400	2.3	21	20	875
January 17	26	129	7,580	28	15,800	2.3	21	2	896
January 19	36	82	7,090	148	13,000	2.3	21	8	849
January 20	46	106	7,620	308	15,600	2.3	21	17	885
January 21	16	132	7,360	104	15,500	2.3	21	6	876
January 22	32	125	8,960	404	18,000	2.3	21	23	1,020
January 23	39	92	8,400	340	17,200	2.3	21	19	975
January 25	32	86	7,780	584	15,900	2.3	21	33	902
January 26	0	210	7,500	0	15,800	2.2	18	0	764
January 27	0	154	7,900	0	16,700	2.3	21	0	944
January 28	0	196	8,070	0	16,800	2.3	21	0	950
January 29	0	196	8,200	0	16,400	2.3	21	0	926
January 30	0	257	8,460	512	16,700	2.3	21	29	946

Partial analyses, gage heights, and rates of discharge of water and solids for Elm Fork of Red River at highway bridge near Mangum, Okla.—Continued.

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–1907.									
January 31	0	208	9,040	596	17,700	2.3	21	34	1,000
February 1	0	165	8,720	268	18,000	2.3	27	20	1,340
February 2	0	138	8,380	244	17,700	2.2	22	14	1,050
February 3	0	53	8,140	308	17,000	2.2	22	18	1,010
February 4	0	138	8,460	320	17,900	2.2	22	19	1,060
February 5	0	165	9,400	2,310	17,300	2.2	22	137	1,030
February 6	0	158	9,030	108	19,200	2.2	22	6	1,140
February 7	6	172	9,150	1,140	18,900	2.2	22	67	1,120
February 8	0	82	9,220	812	19,000	2.2	22	48	1,130
February 9	0	188	9,310	412	18,400	2.2	22	25	1,090
February 10	0	218	9,090	100	18,100	2.2	22	6	1,080
February 11	0	208	9,250	384	17,900	2.2	22	23	1,070
February 12	0	244	8,120	68	16,600	2.2	22	4	990
February 13	0	208	8,920	172	17,800	2.4	32	15	1,540
February 14	0	221	9,360	308	18,700	2.4	30	25	1,520
February 17	0	248	8,210	0	16,700	2.3	20	0	901
February 18	0	224	8,350	272	16,500	2.3	20	15	892
February 19	0	208	7,950	396	16,000	2.4	20	21	866
February 20	0	231	9,330	320	15,000	2.4	18	16	727
February 22	0	190	8,020	216	16,300	2.3	14	8	615
February 23	0	214	8,320	188	16,900	2.3	14	7	638
February 24	0	199	8,460	2,140	14,900	2.2	14	81	565
February 25	0	115	8,530	760	17,000	2.2	14	29	643
February 26	0	185	8,770	380	18,000	2.2	14	14	678
February 27	0	188	9,580	192	18,200	2.2	14	7	688
February 28	0	182	9,020	44	18,400	2.2	14	2	697
March 1	0	121	8,950	64	19,000	2.2	14	2	720
March 2	0	134	9,430	0	19,800	2.2	14	0	750
March 3	0	153	9,670	0	20,800	2.2	14	0	785
March 4	0	153	9,430	0	19,500	2.2	14	0	735
March 5	0	153	9,520	208	20,200	2.2	14	8	765
March 6	0	140	10,300	0	21,700	2.2	14	0	820
March 7	0	153	10,000	0	20,900	2.2	14	0	790
March 8	0	153	10,000	0	21,000	2.2	14	0	795
March 9	0	153	10,300	0	21,400	2.2	14	0	805
March 10	0	153	10,500	0	21,600	2.2	14	0	815
March 11	0	160	11,100	0	22,400	2.2	14	0	845
March 12	0	160	11,100	0	22,900	2.2	14	0	865
March 14	0	102	11,400	236	23,400	2.2	14	9	880
March 15	0	153	11,400	152	23,400	2.2	14	6	885
March 16	0	153	11,100	0	29,400	2.2	14	0	1,110
March 17	0	153	11,500	236	23,500	2.2	14	9	890
March 18	9	153	11,900	380	22,000	2.2	14	14	835
March 19	0	153	10,600	304	22,500	2.2	14	11	850
March 20	0	160	10,600	356	22,500	2.2	14	13	850
March 21	0	153	11,100	396	22,500	2.2	14	15	850
March 22	0	160	11,200	772	23,400	2.2	13	27	820
March 23	0	153	11,000	584	22,500	2.2	12	19	730
March 24	0	153	10,900	644	22,100	2.2	12	21	715
March 25	0	147	11,100	420	22,300	2.2	12	14	720
March 26	0	128	10,900	0	22,900	2.2	12	0	744
March 27	0	147	10,600	0	22,000	2.3	17	0	1,010
March 28	0	153	10,500	0	21,900	2.3	17	0	1,010
March 29	0	153	10,400	0	21,900	2.3	17	0	1,000
March 30	0	128	10,400	0	21,700	2.3	17	0	996
March 31	0	140	10,600	0	22,200	2.2	17	0	1,020
April 1	0	128	10,600	2,320	22,400	2.2	17	107	1,030
April 2	0	128	10,900	1,260	22,600	2.2	17	58	1,040
April 3	0	140	10,800	736	22,600	2.2	17	34	1,040
April 4	0	89	2,540	8,250	5,800	4.8	1,320	29,400	20,700
April 5	0	64	242	5,950	1,340	6.0	2,720	43,700	9,840
April 6	0	77	1,550	1,640	3,860	3.4	340	1,510	3,540
April 7	0	217	1,260	308	4,550	3.0	150	125	1,840
April 8	0	109	1,180	796	4,620	3.1	180	386	2,240
April 9	0	108	2,150	164	6,230	2.7	78	35	1,290
April 10	0	115	3,380	0	8,400	2.6	48	0	1,080
April 11	0	115	4,110	0	9,720	2.5	32	0	843
April 12	0	111	3,990	8	9,910	2.4	37	1	990

Partial analyses, gage heights, and rates of discharge of water and solids for Elm Fork of Red River at highway bridge near Mangum, Okla.—Continued.

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–1907.									
April 13	0	89	1,140	15,000	2,690	4.2	840	33,900	6,100
April 14	0	89	2,270	708	6,730	2.6	48	92	874
April 15	0	89	2,020	188	6,360	2.6	48	24	824
April 16	0	102	2,150	112	6,690	2.5	32	10	578
April 17	0	121	2,660	172	7,350	2.4	26	12	515
April 18	0	128	3,500	188	8,750	2.4	26	13	614
April 19	0	128	4,200	172	10,200	2.4	26	12	714
April 20	0	128	4,910	132	11,500	2.5	32	11	993
April 21	0	128	5,380	376	12,200	2.5	32	32	1,050
April 22	0	134	5,440	176	12,400	2.5	32	15	1,070
April 23	0	128	5,750	180	12,900	2.4	26	13	907
April 24	0	128	5,320	196	12,300	2.4	22	12	730
April 25	0	96	5,240	0	12,300	2.3	20	0	663
April 26	0	128	5,190	0	12,300	2.3	20	0	665
April 27	0	134	5,680	0	13,300	2.3	20	0	720
April 28	0	131	6,160	0	14,300	2.2	18	0	695
April 29	0	144	6,400	0	14,200	2.3	20	0	769
April 30	0	134	6,040	212	13,800	2.2	18	10	672
May 1	0	128	1,520	16,800	4,960	5.2	1,730	78,200	23,100
May 2	0	64	555	.....	3,240	2.8	96	.....	839
May 3	0	89	1,420	100	4,840	2.5	48	11	627
May 4	0	115	2,480	0	7,130	2.4	33	0	635
May 5	0	115	3,930	0	9,970	2.6	63	0	1,690
May 6	0	128	3,500	100	8,950	2.4	33	9	797
May 7	0	128	3,810	0	9,640	2.4	33	0	858
May 8	0	134	5,020	0	11,800	2.4	33	0	1,050
May 9	0	140	5,800	68	13,200	2.4	33	6	1,180
May 10	0	147	6,040	0	14,100	2.3	21	0	801
May 11	0	153	6,520	0	14,700	2.3	21	0	830
May 12	0	140	6,880	0	15,700	2.3	21	0	893
May 13	0	134	7,380	1,100	16,500	2.3	21	62	937
May 14	0	147	7,490	36	17,000	2.3	21	2	964
May 15	0	96	604	14,100	3,300	5.2	1,730	656,001	5,400
May 16	0	70	532	2,280	3,360	3.0	150	925	1,360
May 17	0	70	949	828	3,540	2.3	90	201	860
May 18	0	77	1,300	292	4,760	2.6	47	37	604
May 19	0	96	1,980	304	5,900	2.5	38	31	605
May 20	0	102	2,560	392	7,040	2.6	47	50	892
May 22	0	115	4,540	156	10,800	2.6	47	20	1,370
May 23	0	89	1,110	4,380	3,600	3.4	340	4,030	3,310
May 24	0	77	319	7,860	2,090	5.0	1,510	32,000	8,500
May 25	0	70	196	6,020	1,930	5.1	1,620	26,300	8,450
May 26	0	51	377	1,450	3,320	3.2	1,730	6,800	15,500
May 27	0	102	928	280	4,460	2.9	122	91	1,470
May 28	0	121	1,480	28	5,770	2.8	97	7	1,510
May 29	0	128	2,010	24	6,770	2.1	10	0	183
May 30	0	134	2,600	68	7,770	2.8	97	18	2,040
June 1	0	57	3,140	216	8,610	2.5	45	26	1,050
June 2	0	102	1,930	5,750	5,930	4.0	700	10,900	11,200
June 3	0	70	271	6,360	2,620	3.6	400	6,860	2,820
June 4	0	70	610	1,720	2,580	3.5	335	1,560	2,330
June 5	0	77	242	3,730	1,640	4.5	890	8,950	3,930
June 6	0	89	581	968	3,280	3.0	150	392	1,330
June 7	0	108	1,240	352	4,520	2.8	95	94	1,200
June 8	0	134	2,000	140	6,120	2.7	77	29	1,270
June 9	0	134	2,620	52	7,340	2.5	45	6	891
June 10	0	134	3,170	392	8,070	2.5	45	48	980
June 11	0	128	3,650	0	9,340	2.5	45	0	1,130
June 12	0	140	3,750	0	9,410	2.6	60	0	1,530
June 13	0	77	2,210	572	6,660	2.8	95	146	1,710
June 14	0	121	1,930	0	6,260	2.6	60	0	1,010
June 15	0	121	2,590	0	7,570	2.5	45	0	920
June 16	0	121	960	10,500	4,370	4.4	1,020	28,900	12,000
June 17	0	83	475	2,230	3,450	3.1	200	1,200	1,860
June 18	0	83	1,070	732	4,600	2.7	96	190	1,190
June 19	0	102	1,170	2,980	4,540	3.0	160	1,290	1,960
June 20	0	105	1,260	200	4,650	2.5	40	22	502
June 21	0	128	2,130	0	6,440	2.5	40	0	695
June 22	0	128	2,980	40	8,390	2.5	40	4	905

Partial analyses, gage heights, and rates of discharge of water and solids for Elm Fork of Red River at highway bridge near Mangum, Okla.—Continued.

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–1907.									
June 23	0	140	3,780	0	9,780	2.5	40	0	1,060
June 24	0	134	2,230	0	10,500	2.4	25	0	709
June 25	0	140	4,010	52	10,400	2.4	25	4	705
June 26	0	102	465	15,700	2,340	5.9	2,580	109,000	16,300
June 27	0	77	515	3,070	2,560	3.0	150	1,240	1,040
June 28	0	96	1,310	456	4,930	2.6	60	74	800
June 29	0	113	2,180	140	6,540	2.5	45	17	795
June 30	0	122	2,990	0	8,160	2.5	45	0	991
July 1	0	128	3,860	44	9,690	2.4	25	3	654
July 2	0	134	4,120	256	10,400	2.4	25	17	704
July 3	0	134	4,540	104	11,500	2.4	25	7	773
July 4	0	153	4,980	304	12,000	2.4	25	21	812
July 5	0	140	5,310	508	12,500	2.4	25	34	842
July 6	0	134	5,620	508	13,000	2.4	25	34	881
July 7	0	140	5,840	212	13,100	2.4	25	14	886
July 8	0	140	5,760	348	12,900	2.4	25	24	872
July 9	0	134	4,430	184	10,600	2.4	25	12	713
July 10	0	108	3,940	276	9,310	2.6	75	56	1,880
July 11	0	121	3,960	2,270	10,500	3.5	380	2,330	10,800
July 12	0	108	1,320	332	3,730	2.6	75	67	755
July 13	0	85	832	6,270	3,570	4.0	700	11,900	6,750
July 14	0	85	832	1,480	3,650	3.0	200	810	2,000
July 15	0	78	1,560	504	4,920	3.6	460	625	6,120
July 16	0	92	931	6,620	3,980	3.9	640	11,400	6,880
July 17	0	98	743	1,460	3,710	2.9	165	652	1,650
July 18	0	72	1,480	460	5,060	2.6	75	93	1,020
July 19	0	118	2,320	76	6,950	2.5	50	10	940
July 20	0	72	69	6,440	660	5.4	1,900	33,100	3,390
July 22	0	85	743	632	3,810	2.7	103	176	1,060
July 25	0	144	2,820	60	7,770	2.5	40	6	840
July 26	0	124	3,230	0	8,650	2.5	30	0	702
July 27	0	103	1,990	1,820	5,960	2.5	30	148	483
July 28	0	92	2,080	3,020	5,220	5.1	1,630	13,300	23,000
July 29	0	85	317	6,320	2,210	4.5	1,060	18,100	6,330
July 30	0	85	436	992	2,970	3.3	196	525	1,570
July 31	0	92	891	272	3,760	2.9	110	81	1,120
August 1	0	105	1,940	220	5,560	2.7	70	42	1,050
August 2	0	105	2,440	72	6,930	2.6	48	9	897
August 3	0	105	2,040	8	6,230	2.6	48	1	807
August 4	0	111	2,720	320	7,470	2.6	48	41	967
August 5	0	137	2,080	496	5,580	2.9	110	147	1,660
August 6	0	78	337	8,700	2,320	5.3	1,840	43,300	11,500
August 9	0	78	515	2,830	2,810	5.0	1,560	11,900	11,800
August 10	0	78	188	7,770	2,190	4.6	1,150	24,100	6,800
August 11	0	92	376	1,150	2,910	3.3	197	610	1,550
August 13	0	78	485	1,300	3,190	3.1	153	537	1,320
August 14	0	111	1,110	252	4,440	2.9	110	75	1,320
August 16	0	111	1,820	100	5,950	2.7	68	18	1,090
August 17	0	118	2,000	48	6,330	2.7	68	9	1,160
August 18	0	104	2,060	92	6,570	2.7	68	17	1,210
August 19	0	118	2,260	0	6,830	2.7	68	0	1,250
August 20	0	111	2,380	36	7,080	2.7	68	7	1,300
August 21	0	124	2,490	124	7,250	2.6	50	17	980
August 22	0	131	2,690	176	7,500	2.6	50	24	1,020
August 23	0	118	2,845	136	8,000	2.6	50	18	1,080
August 24	0	112	3,060	372	8,290	2.6	48	48	1,070
August 25	0	114	2,890	0	8,200	2.6	48	0	1,060
August 26	0	95	475	11,200	2,080	5.0	1,520	45,800	8,530
August 27	0	89	97	5,480	1,970	4.5	1,060	15,700	5,650
August 28	0	88	610	780	3,330	3.0	112	236	1,010
August 30	0	110	1,580	24	5,630	2.8	75	5	1,140
August 31	0	118	2,390	76	7,000	2.6	48	10	908
September 1	0	124	2,720	228	7,370	2.6	50	31	996
September 2	0	108	1,470	696	5,250	2.8	90	169	1,280
September 3	0	92	1,560	2,460	4,710	2.6	50	333	635
September 4	0	46	412	7,530	2,520	4.7	1,240	25,200	8,420
September 5	0	80	430	1,340	2,510	3.7	475	1,720	3,220
September 6	0	94	888	692	4,360	3.0	138	258	1,620

Partial analyses, gage heights, and rates of discharge of water and solids for Elm Fork of Red River at highway bridge near Mangum, Okla.—Continued.

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–1907.									
September 7	0	110	1,320	676	4,750	2.7	68	124	870
September 8	0	133	1,620	72	5,740	2.7	68	13	1,050
September 9	0	129	1,920	28	6,340	2.7	68	5	1,180
September 10	0	111	2,120	204	6,840	2.7	68	37	1,250
September 11	0	139	2,460	264	7,590	2.6	50	36	1,030
September 12	0	111	2,290	464	7,170	2.8	88	110	1,700
September 13	0	115	2,310	228	7,030	2.6	50	31	950
September 14	0	75	2,270	216	7,080	2.6	50	29	955
September 15	0	111	631	7,270	3,060	4.0	700	13,700	5,800
September 16	0	96	1,150	972	4,760	3.1	165	433	2,120
September 17	0	88	164	9,440	1,850	7.9	6,180	158,000	30,800
September 18	0	82	192	2,050	2,110	4.0	700	3,870	3,980
September 19	0	84	193	3,400	1,510	4.0	700	6,310	2,850
September 20	0	104	722	272	3,660	3.2	200	147	1,980
September 21	18	67	881	212	3,960	3.1	165	94	1,760
September 22	20	94	1,180	420	4,750	3.2	200	227	2,560
September 24	0	119	2,000	124	5,500	2.9	110	37	1,640
September 25	26	69	1,890	200	6,300	2.8	90	49	1,530
September 27	12	98	2,300	180	7,350	2.9	110	53	2,190
September 28	18	92	2,400	72	7,370	2.7	70	14	1,390
September 29	22	84	2,510	16	7,670	2.7	70	3	1,450
September 30	20	86	2,690	184	7,950	2.8	90	45	1,930
October 1	17	89	2,810	40	8,360	2.8	85	9	1,920
October 4	5	123	3,000	96	9,090	2.6	32	8	785
October 5	20	92	2,970	56	8,710	2.6	32	5	753
October 7	7	111	3,100	56	9,150	2.7	59	9	1,460
October 9	13	103	3,240	256	9,330	2.7	59	41	1,490
October 10	0	141	3,000	120	8,920	2.6	38	12	913
October 11	14	95	3,190	256	9,140	2.6	38	26	937
October 12	6	126	3,350	308	9,680	2.5	19	16	497
October 13	14	85	3,400	228	9,850	2.5	19	12	506
October 14	0	113	1,720	6,740	4,040	5.5	2,050	37,300	22,400
October 15	0	73	80	5,330	1,070	6.3	3,180	45,800	9,200
October 16	0	113	333	1,290	2,440	2.4	6	21	39
October 17	0	139	808	596	3,520	3.3	350	563	3,330
October 18	0	153	1,100	296	4,320	3.2	300	240	3,500
October 19	0	208	1,280	272	4,800	3.1	215	158	2,790
October 20	0	154	1,530	456	5,200	3.1	215	265	3,020
October 21	0	78	1,820	124	5,760	3.0	160	54	2,490
October 22	0	138	1,810	188	5,610	3.0	160	81	2,430
October 23	0	166	1,870	152	5,820	3.1	215	88	3.380
October 24	0	164	1,780	412	5,440	3.1	215	239	3,150
October 25	0	163	1,900	256	5,810	3.0	160	111	2,510
October 26	0	157	1,970	316	5,970	2.9	115	98	1,850
October 27	0	164	2,110	572	6,240	2.9	115	177	1,930
October 28	0	160	2,340	164	6,490	2.9	115	51	2,010
October 31	0	152	2,490	16	7,030	2.9	115	5	2,180
November 27	0	134	932	264	3,690	3.1	175	125	1,740
November 28	0	147	1,040	252	3,920	3.0	145	99	1,530
November 29	0	103	229	2,600	1,460	4.5	1,220	8,560	4,820
November 30	0	109	243	996	2,000	4.1	870	2,340	4.700
December 1	0	148	462	708	2,830	4.1	870	1,660	6,650
December 2	0	163	509	374	3,360	4.7	1,300	1,310	11,800
December 3	0	173	617	68	3,740	4.1	870	160	8,780
December 4	0	123	196	1,390	2,090	3.9	700	2,630	3,950
December 5	0	167	540	140	3,680	3.8	600	227	5,950
December 6	0	170	708	168	4,170	3.7	520	236	5,860
December 7	0	159	794	136	4,160	3.6	445	163	5.000
December 8	0	164	857	284	4,220	3.6	445	341	5,070
December 9	0	172	918	256	4,140	3.5	380	263	4,250
December 10	0	172	998	184	4,320	3.5	380	189	4,430
December 11	0	167	1,010	304	4,390	3.5	380	312	4,500
December 12	0	147	1,060	300	4,310	3.5	380	308	4.420
December 14	0	166	1,130	192	4,520	3.4	315	163	3,850
December 15	0	147	1,200	32	4,670	3.4	315	27	3,990
December 16	0	156	1,240	292	4,610	3.3	215	170	2,680
December 17	0	170	1,260	232	4,700	3.3	215	135	2,730
December 19	0	181	1,380	308	4,800	3.3	210	175	2,720

Partial analyses, gage heights, and rates of discharge of water and solids for Elm Fork of Red River at highway bridge near Mangum, Okla.—Continued.

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter	Dissolved solids.
1905–1907.									
December 20	0	169	1,350	148	4,900	3.3	210	84	2,770
December 21	0	157	1,450	200	5,000	3.3	210	113	2,840
December 22	0	172	1,420	92	5,040	3.3	210	52	2,860
December 23	0	174	1,510	56	5,190	3.3	210	32	2,940
December 24	0	156	1,540	128	5,110	3.2	157	54	2,170
December 25	0	163	1,570	64	5,330	3.2	157	27	2,260
December 26	0	170	1,580	104	5,280	3.2	157	44	2,230
December 27	0	166	1,590	116	5,220	3.2	157	49	2,210
December 28	0	150	1,640	140	5,350	3.2	155	59	2,240
December 29	0	152	1,660	144	5,320	3.2	155	60	2,230
December 30	0	132	1,680	180	5,440	3.2	150	73	2,200
December 31	0	157	1,770	196	5,500	3.5	350	185	5,200
January 1	0	137	1,780	0	5,580	3.1	128	0	1,930
January 2	0	147	1,780	328	5,480	3.1	128	113	1,890
January 3	0	157	1,820	200	5,640	3.1	128	69	1,950
January 4	0	137	1,770	304	5,440	3.1	128	105	1,880
January 5	10	128	1,900	212	5,750	3.1	128	73	1,990
January 6	0	157	2,010	280	5,990	3.1	128	10	2,070
January 7	0	147	2,020	200	5,940	3.1	128	69	2,030
January 8	0	122	1,960	172	5,720	3.1	128	59	1,980
January 9	0	127	969	1,090	3,380	3.1	128	376	1,170
January 10	0	100	267	3,160	1,820	4.1	600	5,120	2,950
January 11	0	109	468	684	2,610	3.1	128	236	900
January 12	0	147	884	260	3,780	3.5	285	200	2,910
January 13	0	118	1,120	136	4,460	3.3	205	75	2,470
January 14	0	116	1,254	100	4,720	3.3	205	55	2,610
January 15	0	107	1,340	148	4,880	3.3	205	82	2,700
January 16	0	118	1,380	88	4,960	3.3	205	49	2,740
January 17	0	110	1,390	68	4,960	3.3	205	38	2,740
January 19	0	111	418	15,900	2,400	8.7	7,600	327,000	49,200
January 20	0	106	364	892	2,840	3.8	440	1,060	3,370
January 21	0	134	648	352	3,480	3.6	340	323	3,190
January 22	0	74	72	1,750	1,330	5.4	1,930	9,100	6,950
January 23	0	154	788	200	3,840	3.5	295	159	3,060
January 24	0	126	854	32	4,140	3.5	295	25	3,300
January 25	0	137	931	240	4,190	3.5	300	194	3,390
January 26	0	120	1,100	200	4,450	3.5	300	162	3,600
January 27	0	176	1,020	816	4,380	3.4	255	562	3,020
January 28	0	196	1,172	376	4,560	3.4	255	259	3,140
January 29	0	193	1,120	372	4,300	3.3	210	211	2,440
January 30	0	179	1,160	136	4,630	3.4	255	94	3,190
January 31	0	174	1,150	344	4,520	3.4	255	237	3,110
February 1	0	164	1,210	388	4,590	3.3	210	220	2,600
February 2	0	197	1,200	136	4,580	3.3	210	77	2,600
February 3	0	189	1,340	289	5,020	3.3	210	159	2,850
February 4	0	206	1,510	376	5,360	3.3	210	213	3,040
February 5	0	196	1,820	204	6,010	3.4	265	146	4,300
February 6	0	206	1,780	260	6,040	3.3	220	155	3,590
February 7	0	162	1,370	272	5,220	3.3	220	162	3,100
February 8	0	153	1,230	112	4,880	3.3	220	67	2,900
February 9	0	157	1,270	108	5,000	3.3	220	64	2,980
February 10	0	162	1,490	32	5,120	3.3	220	19	3,070
February 11	0	162	1,460	172	5,100	3.3	220	102	3,030
February 12	0	172	1,540	112	5,170	3.3	220	67	3,070
February 13	0	143	1,630	244	5,380	3.2	185	122	2,690
February 15	0	153	1,720	300	5,370	3.1	150	122	2,170
February 16	0	143	1,760	484	5,440	3.1	150	196	2,200
February 17	0	148	1,740	268	5,630	3.1	150	109	2,280
February 18	0	162	1,760	432	5,640	3.1	150	175	2,280
February 19	0	158	1,830	264	5,640	3.1	150	107	2,280
February 20	0	153	1,920	440	5,820	3.9	540	641	8,470
February 21	0	134	1,860	112	5,940	3.0	120	36	1,930
February 23	0	138	1,980	156	6,020	3.0	125	58	2,030
February 24	9	119	1,940	232	5,740	3.0	125	78	1,940
February 25	9	129	2,030	128	5,920	3.0	125	43	2,000
February 26	5	148	1,970	312	5,880	3.0	125	105	1,970
February 27	5	148	2,080	100	6,100	3.0	125	34	2,060
February 28	9	124	2,290	80	6,260	3.0	125	27	2,120

Partial analyses, gage heights, and rates of discharge of water and solids for Elm Fork of Red River at highway bridge near Mangum, Okla.—Continued.

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–1907.									
March 1	0	138	1,980	32	5,830	3.0	125	11	1,970
March 2	5	148	1,850	32	5,880	3.0	125	11	1,990
March 3	0	153	2,060	120	6,040	2.9	95	31	1,550
March 4	5	129	2,110	300	6,140	2.9	95	77	1,570
March 5	0	138	2,150	248	6,280	2.9	95	64	1,610
March 6	0	134	2,270	108	6,520	2.9	95	28	1,670
March 7	0	148	2,300	36	6,580	2.9	95	9	1,690
March 8	0	143	2,320	184	6,550	2.9	160	50	1,770
March 9	9	129	2,230	24	6,340	3.0	128	8	2,190
March 10	0	153	2,320	128	6,530	3.0	128	44	2,260
March 11	0	153	2,310	60	6,440	3.0	128	21	2,230
March 12	5	124	2,180	16	6,580	3.0	128	6	2,270
March 13	5	134	2,340	12	6,750	3.0	128	4	2,330
March 14	5	134	2,360	8	6,670	3.0	128	3	2,310
March 15	5	129	2,390	12	6,840	3.0	128	4	2,360
March 16	0	119	2,410	16	7,000	3.9	540	23	10,200
March 17	0	115	2,410	8	7,010	2.9	100	2	1,910
March 18	0	129	2,500	12	6,960	2.9	100	3	1,880
March 19	0	124	2,500	12	7,120	2.9	100	3	1,920
March 20	5	124	2,690	12	7,310	3.9	540	17	10,700
March 21	5	115	2,700	12	7,510	3.9	540	17	11,000
March 22	0	134	2,800	4	7,620	2.8	77	1	1,580

Relative amount of substances in solution in water from Elm Fork of Red River at highway bridge near Mangum, Okla.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905–1907.											
April 13–June 15	20	−1.0	8,280	7.4	1.2	25	0.00	1.7	18	42	T.
June 18–July 15	27	−3.1	9,100	11	1.2	[a] 24	.00	1.5	20	48	0.001
July 16–November 18	25	− .7	9,310	6.9	1.1	26	.00	1.2	16	43	T.
November 19–December 14	25	.....	10,100	6.4	1.0	26	.00	1.4	.....	45	.000
December 17–January 13	27	− .6	13,100	4.6	1.3	28	.00	1.2	12	47	.000
January 14–25	10	.....	15,500	.....	.....	29	.00	.95	12	47	.000
January 26–February 28	31	−2.3	16,400	4.6	1.1	28	.00	.96	11	48	.000
March 1–31	30	− .6	21,600	3.9	1.0	29	.00	.69	9.6	48	.000
April 1–30	30	+2.5	11,100	5.9	1.2	27	.00	1.2	12	42	.000
May 1–30	28	.....	8,520	6.9	2.1	21	.....	.....	15	.....	.....
June 1–30	30	+1.4	5,750	9.9	2.6	20	.00	2.2	25	34	.000
July 1–31	28	− .1	7,020	9.0	1.2	23	.00	1.4	22	38	.000
August 1–31	26	.....	5,360	12	1.3	.....	.12	1.7	28	29	.000
September 1–30	28	.....	5,400	11	1.4	.....	.00	2.2	28	30	.000
October 1–31, and November 27–30	29	+ .1	6,110	9.8	1.7	21	.00	2.0	26	35	.001
December 1–31	29	+ .4	4,620	13	2.3	16	.00	3.4	35	26	.001
January 1–31	25	+ .5	4,140	8.8	4.9	15	.00	3.0	36	25	.000
February 1–28	26	+ .3	5,440	11	2.2	18	.00	2.3	29	30	.004
March 1–22	22	.....	6,670	9.4	2.1	17	.00	1.8	.....	34	.000
Mean	.....	1.0	9,130	8.4	1.7	23	.01	1.7	21	38	T.

[a] Sodium is 99 per cent and potassium is 0.73 per cent of this amount.

Monthly discharge, in second-feet, of Elm Fork of Red River near Mangum, Okla.

Month.	1905.	1906.	1907.	1908.	Mean.
January	.....	22	546	88	219
February	.....	21	173	107	100
March	.....	14	143	53	70
April	[a] 242	209	112	.....	188
May	760	324	464	.....	516
June	367	255	853	.....	492
July	91	281	127	.....	166
August	109	438	135	.....	227
September	36	414	39	.....	163
October	12	274	898	.....	395
November	151	248	89	.....	163
December	34	366	150	.....	183
Mean	.....	239	311	.....	240

[a] April 12–30.

FEATHER RIVER NEAR OROVILLE, CAL.

Samples of water were collected from Feather River near Oroville, Cal., between June 25, 1905, and February 14, 1907. A gaging station was established near Oroville by the United States Geological Survey January 1, 1902. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for this station have been published by the Survey in the following reports:

Water-Supply Papers: 66, p. 167; 81, pp. 85–87; 85, pp. 133–135; 100, pp. 272–274; 134, pp. 137–140; 177, pp. 155–158; 213, pp. 120–121; 251, pp. 199–202.

Additional information in regard to the quality of the water of Feather River is contained in Water-Supply Paper 237, "Quality of California surface waters," pages 36–38.

Partial analyses, gage heights, and rates of discharge of water and solids for Feather River near Oroville, Cal.

[Drainage area, 3,640 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–1907.									
June 25	.....	.....	.....	100	70	2.8	2,790	753	527
July 8, 9, 10, 12, 13, 14, 15	0	84	8	50	96	1.8	1,860	251	482
July 16, 17, August 5, 6, 7, 8, 9, 10, 11, 12	0	96	15	16	176	1.2	1,440	62	684
August 13, 20, 24, 25, 26	0	82	6	44	96	1.1	1,370	163	355
August 29, 31, September 2, 3, 4, 5, 7	0	93	.....	10	132	0.9	1,250	34	445
September 11, 13, 14, 15, 16, 19, 20, 21	0	92	11	34	122	0.9	1,240	114	408
September 23, 24, 25, 26, 27, 29, 30	0	88	8	30	114	1.0	1,290	105	397
October 1, 2, 3, 4, 5, 6, 7	0	88	5	4	128	1.0	1,280	14	442
October 7	.....	.....	.....	0	132	1.0	1,300	0	463
October 8, 9, 10, 11, 12, 13, 14	0	97	13	2	150	1.0	1,310	7	530
October 16, 17, 18, 19, 20, 21, 22	1	92	8	46	118	1.0	1,280	159	408
October 23, 24, 26, 27, 28	0	87	7	62	138	1.0	1,280	214	477
October 29, 30, November 1, 2, 3	0	93	11	30	142	1.0	1,300	105	498
November 5, 6, 7, 8, 9, 10, 11	0	89	5	92	202	0.9	1,240	308	676
November 12, 13, 15, 16, 17, 18	0	97	14	90	158	0.9	1,220	296	520
November 19, 20, 21, 22, 24, 25	0	90	11	24	132	1.2	1,420	92	506
November 26, 27, 29, 30, December 1, 2	0	92	4	16	136	1.3	1,490	64	547
December 4, 5, 6, 7, 8, 9	0	102	11	30	134	1.0	1,310	106	473
December 10, 14, 15, 17, 18, 19, 20, 22, 23	0	82	13	2	128	1.1	1,370	7	474
December 25, 26, 27, 28, 29, 30	0	79	11	60	92	1.2	1,450	235	360
December 31, January 5, 7, 8, 9, 13	0	79	5	158	54	2.2	2,630	1,120	384
January 14, 15, 16, 17, 19, 20	0	53	7	272	134	14.5	36,400	26,700	13,200
January 22, 23, 24, 25, 26, 27,	0	73	12	4	116	8.0	9,690	105	3,030
January 28, 29, 30, 31, February 1, 2, 3	0	66	7	4	110	5.7	5,900	64	1,750
February 4, 6, 7, 8, 9, 10	0	63	8	0	118	5.3	5,380	0	1,710
February 12, 13, 15, 16, 17	0	53	4	80	84	7.8	9,590	2,070	2,180
February 20, 21, 23, 24	0	46	8	114	68	10.9	17,200	5,300	3,160
March 16, 17, 18	0	69	15	72	132	9.8	13,900	2,700	4,950
March 19, 20, 21, 22, 23, 24	0	97	16	38	132	12.2	23,800	2,440	8,480
March 25, 26, 27, 30, 31	0	62	10	156	102	16.8	46,600	19,600	12,800
April 1, 2, 3, 4, 5, 6, 7	0	67	15	118	110	12.6	24,700	7,870	7,340
April 8, 9, 10, 11, 12, 13, 14	22	22	2	112	96	10.8	17,100	5,170	4,440
April 22, 23, 24, 25, 26, 27, 28	13	198	32	64	316	11.1	18,000	3,110	15,300
May 6, 7, 8, 10, 11, 12	0	51	2	28	74	11.9	21,200	1,600	4,240
May 14, 19, 20	12	6	.....	70	100	9.6	13,100	2,480	3,540
May 27, 28, 29, 30, 31, June 1, 2	16	13	3	172	84	11.4	19,200	8,970	4,350
June 3, 4, 5, 6, 7, 8, 9	17	10	5	44	60	11.1	18,300	2,180	2,970
June 10, 11, 12, 14, 15	0	41	10	90	104	10.2	15,000	3,650	4,220
June 17, 19, 20, 21, 22	0	35	5	74	70	9.6	13,200	2,640	2,500
June 24, 25, 26, 28, 29, 30	0	42	10	14	64	7.4	8,280	313	1,430
July 1, 3, 4, 5, 6, 7	0	51	10	14	80	6.5	6,940	262	1,500
July 8, 9, 10, 11, 12, 14	30	0	3	0	80	6.0	6,240	0	1,350
July 15, 16, 17, 18, 19, 20, 21	26	6	10	10	114	4.9	5,010	135	1,540
July 23, 25	0	92	4	138	82	4.4	4,380	1,630	970
September 7, 9, 11	0	84	.....	90	72	1.9	1,970	479	383
September 16, 17, 22, 29	0	80	6	98	66	1.8	1,960	519	349
October 1, 2, 3, 5	0	92	4	82	96	1.8	1,920	425	498
October 7, 8, 9, 10, 11, 12, 13	0	91	4	76	100	1.8	1,920	394	518
October 14, 15, 16, 17, 18, 19	0	88	8	66	94	1.8	1,920	342	487
October 21, 22, 23, 25, 27	0	87	7	8	124	1.8	1,920	41	643
October 28, 30, 31, November 1, 2, 3	0	104	9	8	134	1.9	2,020	44	732
November 4, 5, 6, 7, 8	0	65	8	216	76	4.0	4,190	2,440	860
November 11, 12, 13	0	76	4	66	84	2.0	2,060	367	467
November 18, 19, 20, 21, 22, 24	0	73	8	32	96	2.0	2,060	178	533
November 25, 26, 27, 28, 29, 30	0	76	6	24	94	2.0	2,020	131	513
December 2, 4, 5, 6	0	79	9	60	62	1.9	1,980	321	332
December 9, 10, 11, 12, 13, 14, 15	0	49	6	144	38	6.1	6,870	2,670	705
December 16, 18, 20, 21, 22	0	66	6	24	60	3.3	3,290	213	533
December 23, 24, 25, 26, 27, 28, 29	0	42	5	98	86	9.3	1,640	434	381
December 30, 31, January 1, 2, 3, 4, 5	0	49	7	18	80	6.9	7,700	374	1,660
January 6, 7, 8, 9, 10, 11, 12	0	53	12	14	92	6.2	6,600	250	1,640
January 13, 14, 15, 16, 17	0	58	8	64	52	6.7	7,460	1,290	1,050
January 20, 21, 22, 24, 26,	0	57	5	40	84	4.7	4,730	510	1,070
January 27, 28, 29, 30, 31, February 1, 2	0	39	5	224	100	10.4	18,000	10,900	4,860
February 3, 4, 5, 6, 7, 8, 9	0	51	8	94	90	16.1	43,500	11,000	10,600
February 10, 11, 12, 13, 14	0	48	10	58	54	9.1	12,200	1,910	1,780

Relative amount of substances in solution in water from Feather River near Oroville, Cal.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905–1907.											
July 8–September 7	29	+10.1	121	17	7.5	16	0.00	74	12	9.1	0.03
September 11–October 14	29	+ 7.4	127	20	5.8	11	.00	73	12	8.7	.14
October 16–November 11	24	+ 8.6	152	16	5.0	15	.00	60	12	18	.12
November 12–December 9	24	.0	106	16	6.5	8.5	.00	75	19	9.3	.04
December 10–January 20	27	.....	96	18	6.7	.....	.00	77	17	11	.14
January 22–February 17	24	+ 9.4	89	17	6.0	13	.00	75	13	3.3	.30
February 20–March 31	18	+ 2.3	101	15	6.0	13	.00	63	21	7.7	.13
April 1–May 12	27	+ 7.3	132	17	4.0	17	.00	68	14	11	.07
May 14–June 15	22	− .5	90	17	7.8	13	.00	91	13	9.9	.00
June 17–July 14	23	+ 9.9	92	16	5.5	12	7.0	55	5.1	8.6	.....
July 15–25	9	+ 9.2	104	13	8.6	12	.00	76	15	1.9	.00
October 1–27	22	+ 8.0	152	14	7.9	18	.00	78	8.6	13	.00
October 28–November 24	20	+ 2.2	112	15	11.0	14	.00	88	14	15	.00
November 25–December 22	22	+11.6	92	19	7.0	13	.00	70	17	5.5	.48
December 23–January 17	26	.....	84	18	.....	.....	.00	.....	17	6.1	.11
January 20–February 14	24	.....	96	.....	6.4	15	.00	77	4.3	19	T.
Mean	.....	6.7	109	17	6.8	14	.44	73	13	9.8	.10

Monthly discharge, in second-feet, of Feather River, near Oroville, Cal.

Month.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	Mean.
January	2,000	7,520	3,300	9,860	14,500	7,130	6,610	7,270
February	19,500	5,430	27,800	9,610	11,100	21,500	6,380	14,500
March	11,100	12,000	39,500	13,600	21,600	36,100	7,240	20,200
April	19,500	19,200	24,500	9,400	19,200	28,600	9,210	18,500
May	12,100	10,000	17,800	7,250	17,500	23,400	8,170	13,700
June	5,610	4,330	7,460	4,100	13,800	15,200	5,310	7,970
July	2,100	2,100	2,910	1,790	5,240	6,000	2,320	3,210
August	1,540	1,510	1,960	1,350	2,490	2,650	1,510	1,860
September	1,320	1,230	2,250	1,270	1,970	1,900	1,250	1,600
October	1,500	1,460	4,140	1 290	1,920	1,850	1,650	1,970
November	3,480	19,900	2,560	1,320	2,410	1,780	1,750	4,740
December	6,290	4,210	5,870	1,380	7,070	6,060	1,910	4,680
The year	7,180	7,410	11,700	5,180	9,900	12,700	4,440	8,350

GALLINAS RIVER NEAR LAS VEGAS, N. MEX.

Samples of water were collected from Gallinas River at Las Vegas Hot Springs, near Las Vegas, N. Mex., between March 19, 1905, and March 31, 1906. A gaging station was established near Las Vegas by the United States Geological Survey August 13, 1903. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for this station have been published by the Survey in the following reports:

Water-Supply Papers: 99, pp. 253–254; 132, pp. 116–118; 174, pp. 115–117; 210, pp. 97–98; 248, pp. 134–137.

Partial analyses, gage heights, and rates of discharge of water and solids for Gallinas River at Las Vegas Hot Springs, near Las Vegas, N. Mex.

[Drainage area, 90 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–6.									
March 19, 20, 21, 22, 23, 24	0	131	14	14	168	2.2	63	2	29
April 26, 27, 28, 29, 30	0	123	8	34	156	3.1	327	30	138
May 10, 11, 12, 13	0	87	6	24	120	2.8	209	14	68
May 14, 15, June 1, 2, 3	5	84	4	12	126	2.6	137	4	47
June 5, 6, 7, 8, 9, 10	5	93	4	6	148	2.4	107	2	43
June 11, 12, 14, 15, 16, 17	7	102	13	206	158	2.2	64	36	27
June 18, 19, 28, 29	6	137	14	0	202	2.0	31	0	17
June 30, July 1, 2, 3, 4, 5, 6, 7, 8	0	179	19	40	250	1.8	16	2	11
July 9, 21, 22	0	169	19	58	244	1.9	18	3	12
July 25, 26, 27, 28, 29	7	168	21	42	244	1.8	15	2	10
July 30, 31, August 1, 2, 3, 4, 5	4	159	12	70	220	2.0	37	7	22
August 6, 7, 8, 9, 10, 11, 12	0	133	12	374	164	2.1	49	49	22
August 13, 14, 15, 16, 17, 18, 19	0	162	16	0	192	1.9	24	0	12
August 20, 21, 22, 23, 24, 25, 26	36	65	6	10	214	1.8	13	0	8
August 27, 28, 29, 30, 31	12	136	2	54	212	1.8	12	2	7
September 8, 9, 10, 11, 13, 14	0	165	16	58	158	1.8	14	2	6
September 15, 16, 18, 19, 20, 22, 23	16	152	30	0	240	1.8	10	0	6
September 24, October 11, 12, 13, 14, 15, 16	6	160	78	26	378	1.6	3	0	3
October 17, 18, 20, 21, 22, 23	0	181	68	28	386	1.6	2	0	2
October 25, 26, 27, 28	0	177	65	0	374	1.6	2	0	2
October 29, 30, November 1, 2, 3, 4	6	162	61	30	344	1.6	2	0	2
November 5, 6, 8, 9, 11	6	160	56	0	318	1.6	2	0	2
November 12, 13, 14, 15, 16, 18	0	176	49	8	298	1.6	4	0	3
November 19, 20, 21, 22, 23, 24, 25	6	112	9	128	184	2.0	31	11	15
November 26, 27, 28, 29, 30, December 1, 2	0	96	11	76	126	2.3	105	22	36
December 3, 4, 5, 6, 7, 8, 9	0	96	10	0	216	1.9	17	0	10
December 10, 11, 12, 13, 14, 15, 16	0	116	28	2	214	1.9	22	0	13
December 17, 18, 19, 20, 21, 22, 23	0	134	16	112	172	1.8	15	5	7
December 25, 26, 27, 28, 29, 30	0	132	13	0	258	1.9	20	0	14
December 31, January 1, 2, 3, 4, 5, 6	0	165	14	136	152	1.9	14	5	6
January 7, 8, 9, 10, 11, 12, 13	10	119	18	18	156	1.8	8	0	3
January 14, 15, 16, 17, 18, 19, 20	0	116	22	54	190	1.8	8	1	4
January 21, 22, 23, 24, 25, 26, 27	3	142	22	4	198	1.8	8	0	4
January 28, 29, 30, 31, February 1, 2	0	168	40	8	216	1.8	8	0	5
February 3, 4, 5, 6, 7, 8, 9	0	157	23	10	230	1.8	8	0	5
February 10, 11, 12, 13, 14, 15, 16, 17	0	160	21	104	178	1.8	8	2	4
February 18, 19, 20, 21, 22, 23, 24	0	162	56	8	220	1.9	17	0	10
February 25, 26, 27, March 1, 2	0	146	33	40	180	1.9	14	2	7
March 4, 5, 6, 7, 8, 10	0	97	24	0	164	2.0	20	0	9
March 11, 12, 13, 14, 15, 16, 17	0	130	18	8	186	2.0	23	0	12
March 18, 19, 20, 21, 22, 23	0	122	11	72	136	2.0	20	4	7
March 24, 25, 26, 27, 28, 29, 30, 31	0	45	19	34	150	2.2	44	4	16

Relative amount of substances in solution in water from Gallinas River at Las Vegas Hot Springs, near Las Vegas, N. Mex.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905–6.											
March 19–June 3	20	+8.8	156	24	3.3	12	0.00	74	16	4.5	0.14
June 5–July 8	25	+1.6	154	24	3.5	12	.00	86	14	7.8	.12
July 9–August 12	22	.....	238	.....	2.4	[a] 11	5.5	66	12	6.3	.08
August 13–September 14	25	.....	218	.....	2.8	11	.00	80	9.6	6.9	.08
September 15–October 28	24	+1.7	331	15	1.8	17	.00	55	11	17	.01
October 29–November 25	25	+3.8	300	16	2.1	18	.00	61	11	15	.03
November 26–December 23	28	.....	158	.....	3.5	15	.00	71	13	8.2	.11
December 25–January 20	27	+4.9	168	21	2.9	17	.00	77	13	11	.05
January 21–February 17	28	−3.0	190	20	3.3	13	.00	71	11	21	.05
February 18–March 17	25	+4.5	172	23	3.3	12	.00	73	12	10	.00
March 18–31	14	.....	164	.....	.....	11	.00	79	13	7.9	.02
Mean	.....	4.0	204	20	2.9	14	.50	72	12	11	.06

[a] Sodium is 87.5 per cent and potassium is 16.5 per cent of this amount.

Monthly discharge, in second-feet, of Gallinas River near Las Vegas, N. Mex.

Month.	1904.	1905.	1906.	1907.	1908.	Mean
January	.....	12	9	14	3	10
February	.....	40	11	15	6	18
March	.....	93	26	28	7	38
April	.....	177	99	44	29	87
May	.....	206	101	91	28	107
June	.....	63	32	64	11	42
July	.....	17	38	25	16	24
August	.....	27	22	27	65	35
September	.....	14	15	23	12	16
October	[a] 33	4	17	2	1	12
November	14	32	16	3	1	13
December	10	19	46	4	5	17
Mean	.....	58	36	28	15	35

[a] October 8–31.

GILA RIVER NEAR SAN CARLOS, ARIZ.

Samples of water were collected from Gila River near San Carlos, Ariz., between April 9, 1905, and January 20, 1906. A gaging station was established near San Carlos by the United States Geological Survey July 11, 1899, and was discontinued December 31, 1905. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for that point have been published by the Survey in the following reports:

Annual Reports: 21, IV, p. 332; 22, IV, pp. 397–398.

Water-Supply Papers: 33, p. 30; 38, pp. 313–314; 39, p. 452; 50, pp. 385–386; 52, p. 520; 66, pp. 98–99; 75, pp. 179–180; 85, pp. 32–35; 100, pp. 48–51; 133, pp. 199–204; 175, pp. 162–163.

Partial analyses and gage heights for Gila River near San Carlos, Ariz.

[Drainage area, 13,500 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).	
1905–6.						
April 9, 10, 11, 12	5	142	37	9,820	302	13.0
April 17, 18, 19, 20	1	146	64	5,410	338	14.2
April 24, 25, 26, 28, 29	0	140	48	9,580	312	14.3
April 30, May 3, 4, 5, 6	0	147	70	4,150	332	13.2
May 10, 11, 12	10	145	100	2,270	402	12.2
May 14, 16, 17, 18, 19	10	156	119	1,770	470	11.8
May 22, 23, 24, 25, 26, 27	6	170	146	1,020	520	11.5
May 28, 29, 30, 31, June 2	6	195	190	710	614	11.1
June 9, 10, 11, 12, 13, 14, 15	0	210	210	2,320	1,800	11.2
June 18, 19, 20, 21, 22, 23, 24	0	256	314	474	970	11.0
June 25, 26, 27, 28, 29, 30, July 1	0	251	434	120	1,190	10.7
July 2, 3, 5, 6, 7	6	256	435	138	1,240	10.5
July 9, 10, 11, 12, 13, 14, 15	0	254	324	3,170	938	10.6
July 16, 17, 22	0	279	466	408	1,280	10.5
July 23, 24, 25, 26, 27, 28	12	273	408	3,900	1,080	10.2
July 29, 30, 31, August 12	0	221	172	20,400	560	11.5
August 13, 14, 15, 16, 17, 18, 19	0	260	302	5,230	850	11.2
August 20, 22, 23, September 5, 7	5	195	176	24,700	650	11.6
September 10, 16, 21, October 1, 2, 6, 7	8	238	314	3,140	926	11.8
October 8, 9, 10, 11, 12, 13, 14	0	298	360	930	1,050	11.3
October 15, 16, 17, 21, 22, 23, 24	12	296	446	240	1,260	11.2
October 25, 26, 30, 31, November 2, 3, 4	0	313	453	126	1,260	11.1
November 5, 6, 7, 8, 9, 10, 11	8	208	236	9,950	764	11.9
November 12, 13, 14, 15, 16, 17, 18	0	230	204	3,160	672	11.8
November 19, 20, 21, 22, 23, 24, 25	0	240	182	3,940	642	12.3
December 5, 6, 7, 8	0	211	123	1,920	552	.....
December 10, 11, 13, 14, 15, 16	0	241	172	940	680	.....
December 17, 18, 19, 20, 21, 22, 23	0	240	162	954	590	.....
December 24, 25, 26, 27, 28, 29, 30	0	250	190	684	626	.....
December 31, January 1, 2	0	255	203	540	694	.....

Relative amount of substances in solution in water from Gila River near San Carlos, Ariz.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905–6.											
April 9–May 6	18	+1.7	312	12	3.1	19	0.00	48	12	20	0.10
May 10–June 2	20	+ .8	556	11	3.1	18	.00	36	12	27	.04
June 9–July 7	26	+ .5	915	9.6	2.8	22	.33	27	12	34	T.
July 9–August 12	20	− .8	942	10	3.0	[a] 20	.00	27	12	35	.02
August 13–October 14	26	+4.8	902	12	2.6	21	.00	29	12	31	.02
October 15–November 18	29	− .1	986	12	2.9	22	.00	36	12	33	.01
November 19–December 23	24	+1.9	620	12	3.2	18	.00	37	12	28	.03
December 24–January 2	10	+ .0	656	11	3.1	21	.00	37	12	30	.04
Mean	.....	1.3	736	11	3.0	20	.04	35	12	30	.03

[a] Sodium is 96 per cent and potassium is 5.9 per cent of this amount.

Monthly discharge, in second-feet, of Gila River near San Carlos, Ariz.

Month.	1899.	1900.	1901.	1902.	1903.	1904.	Mean.
January	.....	.....	199	100	141	32	118
February	.....	.....	1,080	55	58	33	306
March	.....	.....	446	10	37	11	126
April	.....	[a] 536	53	0	55	5	130
May	.....	307	5	0	4	9	65
June	.....	63	3	0	116	0	36
July	[b] 1,780	0	368	19	52	143	394
August	405	12,300	536	792	877	952	2,640
September	453	50,300	250	98	281	232	8,600
October	[c] 161	2,580	91	0	118	825	629
November	.....	10,500	232	0	57	112	2,180
December	.....	5,720	109	558	34	306	1,350
The year	.....	.....	281	136	152	222	1,380

[a] Approximate. [b] July 11–31. [c] October 1–14.

GRAND RIVER NEAR KREMMLING, COLO.

Samples of water were collected from Grand River at Gore Canyon near Kremmling, Colo., from April 23, 1905, to May 15, 1906. A gaging station was established at Gore Canyon by the United States Geological Survey July 24, 1904. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for the station have been published by the Survey in the following reports:

Water-Supply Papers: 133, pp. 137–139; 175, pp. 78–81; 211, pp. 69–71; 249 pp. 95–98.

Partial analyses, gage heights, and rates of discharge of water and solids for Grand River at Gore Canyon, near Kremmling, Colo.

[Drainage area, 2,380 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–6.									
April 23, 24, 26	0	110	22	2,240	204	3.5	1,000	6,050	551
May 11, 12, 13	0	90	3	106	134	6.2	2,190	627	792
May 14, 15, 16, 17, 18, 19, 20	0	75	6	180	122	7.2	2,800	1,360	922
May 21, 22, 24, 25, 26, 27	0	72	8	162	176	10.8	5,520	2,020	2,620
May 28, 29, 31, June 1, 2	0	59	5	258	110	11.1	6,010	4,180	1,780
June 5, 6, 7, 9	0	56	8	202	84	15.1	11,400	6,220	2,590
June 10, 11, 12, 13, 15, 16	0	55	13	134	108	13.8	9,630	3,480	2,810
July 5, 6, 7	0	66	8	116	120	6.6	2,480	776	803
July 9, 10, 11, 12, 13, 14, 15	0	56	10	64	164	5.8	1,970	341	872
July 16, 17, 18, 19, 20, 21, 22	0	69	4	66	152	5.5	1,790	319	734
July 23, 24, 25, 26, 27, 28	0	76	8	30	192	4.5	1,370	111	710
August 1, 2, 3, 4, 5	0	65	18	62	148	4.8	1,210	202	483
August 6, 7, 8, 9, 10, 11	0	68	8	96	104	3.4	976	253	274
August 13, 14, 15, 16, 18, 19	0	56	2	32	152	3.1	863	75	354
August 20, 21, 23, 24, 25, 26	0	70	9	90	124	2.4	650	158	218
August 27, 28, 29, 30, 31, September 1, 2	0	59	.....	112	110	2.6	702	212	208
September 3, 4, 5, 6, 7, 8, 9	0	73	8	56	80	2.4	634	96	137
September 15, 16, 18, 19, 20, 21, 22, 23	0	78	5	84	76	1.7	472	107	97
September 24, 26, 28, 29, 30, October 1, 2	0	79	6	168	112	1.7	455	206	137
October 10, 11, 12, 13, 14, 15, 16	0	99	7	96	134	1.5	414	107	150

Partial analyses, gage heights, and rates of discharge of water and solids for Grand River at Gore Canyon, near Kremmling, Colo.—Continued.

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–6.									
October 17, 18, 19, 20, 21	0	84	7	104	114	1.8	483	136	149
October 22, 23, 24, 25, 26, 28	0	75	8	46	104	1.7	477	59	134
October 29, 30, 31, November 1	0	87	5	76	106	1.7	460	95	132
November 7, 8, 9, 10, 11	0	88	13	78	130	1.5	431	91	151
November 12, 13, 14, 16, 17	0	92	7	148	168	1.5	411	164	186
December 7, 8, 9, 10, 11, 13, 17	0	96	7	0	180	1.3	391	0	190
December 21, 22, 23, 24, 25, 26, 28, 30	0	94	7	56	124	1.5	255	39	85
January 10, 11, 12, 13	0	99	7	10	122	.....	.....	.....	.....
January 14, 15, 16, 17, 18, 19, 20	0	96	7	48	144	.....	.....	.....	.....
January 21, 22, 23, 24, 26, 28	0	102	7	26	118	.....	.....	.....	.....
January 30, February 2, 5, 6, 7, 8, 9, 10	0	87	5	14	128	.....	.....	.....	.....
February 11, 13, 14, 15, 16, 17	13	59	18	0	138	.....	.....	.....	.....
February 18, 19, 20, 21, 22, 23, 24	0	87	13	112	120	.....	.....	.....	.....
March 3, 4, 5, 6, 7, 8, 9	0	84	14	32	96	.....	.....	.....	.....
March 10, 11, 12, 13, 14, 15, 16, 17	0	87	10	24	142	.....	.....	.....	.....
March 18, 19, 20, 22	0	88	19	8	170	.....	.....	.....	.....
March 25, 26, 27, 28, 29, 30, 31	0	86	19	144	208	.....	.....	.....	.....
April 2, 3, 4, 5, 6, 7	10	72	14	240	144	3.5	1,020	661	396
April 8, 9, 10, 11, 12, 13, 14	0	82	10	264	166	3.7	1,090	777	488
April 15, 16, 17, 18, 19, 21, 22, 23	28	20	2	254	116	5.0	1,640	1,120	513
April 25, 26, 27, 28, 29, 30	6	51	5	158	118	5.4	1,950	831	621
May 1, 2, 3, 4, 5	0	83	3	132	116	5.3	1,730	616	542
May 6, 7, 8, 9, 10, 11, 12	6	51	5	302	162	8.4	3,810	3,110	1,670
May 13, 14, 15	0	108	5	188	76	9.0	4,220	2,140	866

Relative amount of substances in solution in water from Grand River at Gore Canyon, near Kremmling, Colo.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905–6.											
April 23–May 27	19	− 2.2	119	16	4.5	12	0.00	68	23	5.3	0.15
August 6–September 2	25	.....	100	.....	4.8	13	.00	66	21	4.2	.04
September 3–October 16	29	+ 7.7	114	24	6.1	12	.00	68	25	9.7	.19
October 17–November 11	20	.....	128	23	7.6	15	.00	.....	21	5.5	.03
November 12–January 13	24	+ 8.3	144	19	5.2	17	.00	68	21	8.3	.09
January 14–February 17	27	− 2.7	120	21	4.2	12	.00	70	26	9.2	.11
February 18–March 22	26	+10.8	91	25	6.5	15	.00	98	11	5.4	.00
March 25–April 23	29	+ 3.5	160	21	4.6	10	.00	60	23	8.8	.08
April 25–May 15	21	− 5.3	140	16	5.3	14	.00	79	21	11	.03
Mean	.....	5.8	124	21	5.4	13	.00	72	21	7.5	.08

Monthly discharge, in second-feet, of Grand River near Kremmling, Colo.

Month.	1904.	1905.	1906.	1907.	1908.	Mean.
January	.....	314	.....	.....	304	309
February	.....	316	.....	[a] 384	306	335
March	.....	390	.....	874	419	561
April	.....	924	1,440	1,690	1,290	1,340
May	.....	3,520	5,060	3,680	2,390	3,660
June	.....	8,000	7,080	9,170	4,720	7,240
July	[b] 1,760	2,050	3,290	6,220	2,010	3,070
August	1,310	866	1,400	1,700	1,310	1,320
September	893	532	1,160	784	597	793
October	646	475	817	719	488	629
November	[c] 470	419	546	407	390	446
December	.....	325	[c] 477	259	303	341
The year	.....	1,510	.....	.....	1,210	1,670

[a] February 18–28. [b] July 24–31. [c] Approximate.

GRAND RIVER NEAR PALISADE, COLO.

Samples of water were collected from Grand River at a highway bridge near Palisade, Colo., from March 15, 1905, to May 5, 1906. A gaging station was established near Palisade by the United States Geological Survey April 9, 1902. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for the station have been published by the Survey in the following reports:

Annual Reports: 19, IV, p. 401; 20, IV, pp. 378–389.
Water-Supply Papers: 85, pp. 46–48; 100, pp. 87–89; 133, pp. 142–144; 175, pp. 84–86; 211, pp. 74–75; 249, pp. 105–107.

Monthly discharge estimates for Grand River at Grand Junction, Colo., 12 miles below Palisade and below the headings of canals in the Grand Valley have been published as follows:[a]

Annual Reports: 19, IV, p. 401; 20, IV, pp. 378, 389; 21, IV, p. 281.
Water-Supply Papers: 74, pp. 130–131.

[a] See also Second Ann. Rept. U. S. Reclamation Service, pp. 215–216.

Partial analyses, gage heights, and rates of discharge of water and solids for Grand River at highway bridge near Palisade, Colo.

[Drainage area, 8,550 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–6.									
March 15, 16, 17, 18	0	104	7	12	192	.....	.....	.....	.....
March 19, 20, 21, 22, 23, 24	0	93	7	1	183	.....	.....	.....	.....
March 26, 27	0	94	7	22	164	.....	.....	.....	.....
April 2, 3, 4, 5, 6	0	95	7	64	162	12.5	1,600	276	699
April 9, 10, 11, 12, 13, 14	0	97	6	240	164	13.2	2,550	1,650	1,130
April 16, 20, 21, 22	0	94	4	186	156	13.4	2,770	1,390	1,170
May 4, 5, 6, 7, 8, 9, 13, 20, 27	0	114	22	564	192	16.1	9,890	15,000	5,120
June 3, 10, 12, 13, 14, 15, 16	0	94	44	240	238	20.8	29,000	18,800	18,600
June 18, 19, 20, 21, 22, 23, 24	0	108	44	198	314	18.6	18,800	10,000	15,900
June 25, 26, 27, 28, 29, 30, July 1	0	84	37	56	248	17.6	14,700	2,200	9,850
July 2, 3, 4, 5, 6, 7, 8	0	100	50	74	262	15.8	8,690	1,740	6,150
July 9, 10, 12, 13, 14, 15	0	101	62	58	354	14.9	6,100	955	5,830
July 16, 17, 18, 19, 20, 21, 22	10	103	83	278	344	14.6	5,310	3,990	4,940
July 23, 24, 25, 26, 27, 28, 29	9	107	108	94	440	13.9	3,960	1,000	4,700
July 30, August 1, 2, 3, 4, 5	0	141	110	158	462	13.9	3,810	1,620	4,750
August 6, 7, 8, 9, 10, 11, 12	0	146	146	482	544	13.4	2,810	3,660	4,130
August 13, 14, 15, 16, 17, 18	0	140	157	156	534	13.3	2,610	1,100	3,760
August 20, 21, 22, 23, 26	0	132	174	200	720	12.7	1,840	993	3,580
August 27, 28, 29, 30, September 1, 2	0	162	191	386	788	12.7	1,830	1,910	3,890
September 3, 4, 5, 6, 18, 19	14	149	177	740	802	12.8	1,930	3,860	4,180
September 7, 8, 9, 13, 14, 15, 16, 17, 18	0	160	185	72	748	12.7	1,810	352	3,650
October 21, 22, 23, 24, 25, 26, 27	0	182	198	340	754	12.7	1,810	1,660	3,680
October 30, 31	0	191	195	90	764	12.7	1,860	452	3,840
April 1, 2, 3, 4, 5, 6, 7	0	160	97	4,340	540	13.0	2,270	26,600	3,310
April 8, 9, 10, 11, 12, 13, 14	0	163	106	3,370	530	13.8	3,600	32,700	5,150
April 15, 16, 17, 18, 19, 20, 21	0	160	87	924	480	14.1	4,240	10,600	5,500
April 22, 23, 24, 25, 26, 27, 28	0	182	53	1,390	414	15.7	8,290	31,200	9,280
April 29, 30, May 1, 2, 4, 5	0	160	53	1,320	440	15.0	6,580	23,400	7,810

Relative amount of substances in solution in water from Grand River at highway bridge near Palisade, Colo.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{4}{3}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905–6.											
March 15–April 22	25	+1.8	167	17	4.1	13	1.5	56	22	8.4	0.00
May 4–July 1	30	+4.9	174	20	4.6	20	.00	64	26	14	.07
July 2–29	27	+0.3	341	10	6.7	[a]16	.00	35	21	26	.03
July 30–August 26	24	+0.9	524	16	1.3	[b]18	.00	27	23	25	.01
August 27–September 18	28	+2.9	755	15	2.8	17	.00	23	26	25	.01
April 1–28	28	+5.7	466	13	5.4	17	.00	37	23	20	.05
April 29–May 5	6	.....	443	17	3.8	14	.00	36	21	.....	.....
Mean	.....	2.8	410	15	4.1	16	.21	40	23	20	.03

[a] Sodium is 89 per cent and potassium is 15 per cent of this amount.
[b] Sodium is 96 per cent and potassium is 5.3 per cent of this amount.

Monthly discharge, in second-feet, of Grand River near Palisade, Colo.

Month.	1897.[a]	1898.[a]	1899.[a]	1902.	1903.	1904.	1905.	1906.	1907.	1908.	Mean.
January	[b] 1,000	[b] 2,940	.....	.....	.....	.....	.....	.....	.....	1,300	1,750
February	[c] 1,050	[c] 2,980	.....	.....	.....	.....	.....	.....	1,460	1,320	1,700
March	[b] 1,100	[b] 2,110	1,800	.....	.....	.....	.....	.....	2,240	1,630	1,780
April	3,720	[b] 4,300	3,940	2,230	2,400	3,910	2,640	4,730	5,250	3,900	3,700
May	29,400	7,130	19,400	11,800	9,030	12,800	13,100	18,600	10,500	6,720	13,800
June	25,400	13,700	31,300	8,870	18,400	16,500	24,400	23,500	24,800	14,600	20,100
July	8,830	4,440	14,100	3,020	8,850	7,400	6,080	9,820	17,000	5,670	8,520
August	3,000	1,130	4,580	1,480	2,280	3,240	2,530	3,800	4,890	3,550	3,050
September	1,800	907	2,160	1,490	2,330	2,650	1,830	3,340	2,600	1,760	2,090
October	1,810	915	.....	1,950	2,100	2,140	1,750	2,850	2,640	1,890	2,000
November	1,660	1,070	.....	.....	.....	.....	.....	.....	1,820	1,600	1,540
December	[b] 1,550	1,010	.....	.....	.....	.....	.....	.....	1,370	1,320	1,310
The year..	6,690	3,550	.....	.....	.....	.....	.....	.....	.....	3,770	5,110

[a] At Grand Junction, Colo. [b] Approximate. [c] February 15–28.

GREEN RIVER NEAR GREEN RIVER, WYO.

Samples of water were collected from Green River at a railroad bridge near Green River, Wyo., from May 1 to November 1, 1905. A gaging station was established at this bridge by the United States Geological Survey May 2, 1895, and was discontinued October 31, 1906. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for the station have been published by the Survey in the following reports:

Annual Reports: 18, IV, pp. 272–275; 19, IV, pp. 395–396; 20, IV, pp. 380–381; 21, IV, pp. 302–303.

Bulletin: 140, p. 201.

Water-Supply Papers: 16, p. 135; 28, pp. 131, 142, 144; 37, pp. 286–287; 39, p. 451; 50, pp. 366–367; 66, pp. 82, 173; 75, p. 164; 85, pp. 75–77; 100, p. 124; 133, pp. 53–56; 175, pp. 14–17; 211, pp. 25–26.

Partial analyses, gage heights, and rates of discharge of water and solids for Green River at railroad bridge near Green River, Wyo.

[Drainage area, 7,450 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905.									
May 1, 2, 3, 4, 5, 6	0	176	22	82	302	1.6	1,300	288	1,060
May 7, 8, 9, 10, 11, 12, 13	18	165	8	2	336	1.5	1,210	7	1,100
May 14, 15, 16, 17, 18, 19, 20	12	162	10	26	330	1.3	943	66	840
May 21, 22, 23, 24, 25, 26, 27	8	137	9	218	272	2.0	1,890	1,110	1,390
May 28, 29, 30, 31, June 1, 2, 3	6	116	8	494	230	2.8	3,370	4,500	2,090
June 4, 5, 6, 7, 8, 9, 10	0	87	5	310	132	3.7	6,200	5,190	2,210
June 11, 13, 14, 15, 16	4	102	10	18	280	3.8	6,810	331	5,150
June 18, 19, 20, 21, 22, 23, 24	0	112	12	38	252	3.6	6,220	638	4,230
June 25, 26, 27, 28, 29, 30, July 1	0	97	46	44	242	3.2	5,480	651	3,580
July 2, 3, 4, 5, 6, 7, 8	0	94	15	84	198	3.1	4,680	1,060	2,500
July 9, 10, 11, 12, 13, 14, 15	0	97	9	56	168	2.7	3,510	531	1,590
July 16, 17, 18, 19, 20, 21, 22	0	104	10	52	142	2.7	3,440	483	1,320
July 23, 24, 25, 26, 27, 28, 29	6	115	12	42	202	2.3	2,360	268	1,290
July 30, 31, August 1, 2, 3, 4, 5	7	110	12	18	232	1.9	1,670	81	1,050
August 6, 7, 8, 9, 10	0	115	12	0	224	1.6	1,310	0	794
August 14, 15, 16, 17, 18, 19	0	127	18	0	246	1.3	1,020	0	677
August 20, 21, 23, 24, 25, 26	13	73	14	50	312	1.2	900	121	757
August 27, 28, 29, 30, 31, September 4, 5	10	104	7	36	238	1.2	900	87	578
September 6, 7, 8, 9, 14, 15	0	136	10	70	170	1.1	793	150	364
September 16, 17, 18, October 17, 18, 19, 20	11	139	11	40	326	0.6	487	53	428
October 21, 22, 23, 24, 25, 26	7	162	33	50	380	0.5	445	60	457
October 27, 28, 29, 30, 31, November 1	0	185	15	22	368	0.5	434	26	432

Relative amount of substances in solution in water from Green River at railroad bridge near Green River, Wyo.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905.											
May 1–27	27	+1.2	294	18	5.8	9.5	0.00	64	29	4.1	0.13
May 28–June 24	26	+3.9	170	18	6.5	12	.00	66	28	5.4	.02
June 25–July 22	28	−5.3	188	15	4.3	15	.00	54	36	12	.01
July 23–August 19	25	+7.7	208	17	4.7	[a]16	.00	60	28	4.4	.04
August 20–October 20	26	+8.6	271	20	4.8	13	.00	53	33	5.2	.07
October 21–November 1	12	−0.6	336	15	5.6	13	.00	53	38	5.1	.04
Mean	.....	4.6	244	17	5.3	13	.00	58	33	6.0	.05

[a] Sodium is 96 per cent and potassium is 5.5 per cent of this amount.

Monthly discharge, in second-feet, of Green River near Green River, Wyo.

Month.	1895.	1896.	1897.	1898.	1899.	1901.	1902.	1904.	1905.	1906.	Mean.
January	.....	.....	[a]1,800	.....	1,880	.....	.....	.....	.....	.....	[a]1,840
February	.....	.....	[a]1,900	.....	2,200	.....	.....	.....	.....	.....	[a]2,050
March	.....	.....	[a]1,900	.....	1,860	.....	.....	.....	.....	.....	[a]1,880
April	.....	[a]1,020	1,960	2,660	1,600	1,320	844	1,960	883	2,040	1,590
May	3,970	2,140	9,770	4,060	3,270	6,750	2,260	6,130	1,580	5,030	4,500
June	4,550	11,800	7,550	9,060	12,500	5,420	7,100	10,200	5,950	6,830	8,100
July	4,120	4,200	2,790	4,620	14,500	2,750	2,670	5,260	3,460	4,860	4,920
August	1,700	1,470	1,600	1,420	5,170	1,410	1,390	2,040	1,120	2,240	1,960
September	638	869	462	646	2,060	632	656	890	639	1,260	875
October	472	[a]745	1,010	347	1,820	.....	329	698	486	660	730
November	[a]309	[a]800	760	405	1,700	.....	.....	.....	.....	.....	795
December	.....	1,080	[a]600	[a]849	1,680	.....	.....	.....	.....	.....	1,050
The year	.....	2,680	.....	.....	4,190	.....	.....	.....	.....	.....	2,520

[a] Approximate.

GREEN RIVER NEAR JENSEN, UTAH.

Samples of water were collected from Green River at Billings ferry, near Jensen, Utah, from March 24, 1905, to May 11, 1906. A gaging station was established at the ferry by the United States Geological Survey November 7, 1903, and was discontinued October 31, 1906. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for the station have been published by the Survey in the following reports:

Water-Supply Papers: 100, pp. 123–124; 133, pp. 56–58; 175, p. 17; 211, pp. 26–28.

Partial analyses, gage heights, and rates of discharge of water and solids for Green River at Billings ferry, near Jensen, Utah.

[Drainage area, 26,600 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–6.									
March 24, 27, April 7	12	142	36	546	374	.....	.....	.....	.....
April 9, 10, 11, 12, 13, 14	5	159	26	1,830	392	.....	.....	.....	.....
April 17, 18, 19, 20	4	168	28	3,440	346	.....	.....	.....	.....
April 25, 26, 27, 28, 29	0	153	18	1,210	284	.....	.....	.....	.....
April 30, May 1, 2, 3, 4, 5	0	142	16	2,630	224	.....	.....	.....	.....
May 6, 8, 9, 10, 11, 12, 13	10	113	18	858	216	.....	.....	.....	.....
May 14, 15, 16, 17, 18, 19, 20	6	116	12	654	222	.....	.....	.....	.....
May 21, 22, 23, 24, 25, 26, 27	0	125	37	1,430	396	.....	.....	.....	.....
May 28, 29, 30, 31, June 1, 2, 3	0	97	8	724	150	9.0	16,000	31,300	6,480
June 4, 5, 6, 7, 8, 9, 10	0	96	8	824	144	10.6	23,000	51,100	8,940
June 11, 12, 13, 14, 15, 16, 17	9	90	21	362	236	10.2	21,000	20,500	13,400
June 18, 19, 20, 21, 22, 23, 24	0	88	12	224	172	8.7	15,000	9,070	6,970
June 25, 26, 27, 28, 29, 30, July 1	0	97	15	250	174	7.3	10,000	6,750	4,700
July 2, 3, 4, 5, 6, 8	0	87	8	50	218	6.5	8,000	1,080	4,710
July 9, 10, 11, 12, 13, 14, 15	0	98	15	68	194	5.4	6,000	1,100	3,140
July 16, 17, 18, 19, 20, 21, 22	0	99	15	76	198	4.8	5,000	1,030	2,670
July 23, 24, 25, 26, 27, 28, 29	6	94	20	170	200	4.2	3,500	1,610	1,890
July 30, 31, August 1, 2, 3, 4, 5	0	132	25	856	296	3.7	3,000	4,500	2,400
August 6, 7, 8, 9, 10, 11, 12	0	124	26	142	256	.....	.....	.....	.....
August 13, 14, 15, 16, 17, 18, 19	0	126	28	1,220	302	.....	.....	.....	.....
August 20, 21, 22, 23, 24, 25, 26	8	111	29	108	200	.....	.....	.....	.....
August 27, 28, 30, 31, September 1, 2	0	135	29	124	294	.....	.....	.....	.....
September 3, 4, 5, 6, 7, 8	0	138	35	1,230	330	.....	.....	.....	.....
September 9, 10, 11, 12, 13, 14, 15	0	130	37	128	312	.....	.....	.....	.....
September 16, 17, 18, 19, 21, 24	0	143	42	538	364	.....	.....	.....	.....
September 26, 27, 28, 29, 30, October 1, 2	0	146	47	17,100	820	.....	.....	.....	.....
October 3, 4, 5, 6, 7, 8, 9, 10	0	167	52	1,980	478	.....	.....	.....	.....
October 11, 12, 13, 14, 15, 16, 17, 18	10	152	49	430	432	.....	.....	.....	.....
October 20, 23, 24, 25, 26, 27, 28	12	149	41	142	414	.....	.....	.....	.....
October 29, 30, 31, November 1, 3	6	164	36	114	414	.....	.....	.....	.....
November 6, 7, 8, 9, 10, 11	0	180	35	122	436	.....	.....	.....	.....
November 12, 13, 14, 15, 17, 18	0	182	49	52	466	.....	.....	.....	.....
November 22, 23, 25, 26, 27, 28, 29	0	185	53	142	406	.....	.....	.....	.....
December 4, 5, 6, 9, 10, 13, 14, 15	0	205	56	84	540	.....	.....	.....	.....
December 16, 18, 19, 22	0	254	63	76	568	.....	.....	.....	.....
December 24, 25, 26, 27, 28, 29	7	243	58	94	560	.....	.....	.....	.....
January 1, 2, 3, 9, 10, 11, 13	0	238	61	24	542	.....	.....	.....	.....
January 14, 15, 16, 17, 18, 19	0	218	54	12	474	.....	.....	.....	.....
January 30, February 1, 3, 4, 8, 9, 10	0	203	49	30	520	.....	.....	.....	.....
February 19, 20, 21, 22, 23, 24	0	191	67	114	390	.....	.....	.....	.....
March 1, 2, 3	0	190	35	168	372	.....	.....	.....	.....
March 4, 5, 6, 7, 8, 9, 10	12	167	60	222	522	.....	.....	.....	.....
March 11, 12, 13, 14	0	160	37	1,810	410	5.9	6,000	29,300	6,640
March 22, 23, 25, 26, 27, 28	0	156	40	9,970	544	6.9	9,880	266,000	14,500
March 29, 30, April 1, 2, 3, 4, 5, 6	0	145	39	510	380	6.7	8,560	81,100	8,780
April 7, 9, 10, 11, 12	0	144	48	2,060	398	5.7	5,410	30,200	5,820
April 17, 18, 19, 21	0	144	24	1,060	316	6.6	7,800	22,300	6,640
April 23, 24, 25, 26, 27, 28, 30	0	131	16	1,450	254	7.9	11,900	46,700	8,160
May 1, 2, 3, 4, 5	0	153	14	1,010	248	7.0	8,960	24,400	6,000
May 7, 8, 9, 10, 11	28	73	10	1,030	256	8.8	15,200	42,300	10,500

Relative amount of substances in solution in water from Green River at Billings ferry, near Jensen, Utah.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905–6.											
March 24–May 5	22	− 2.0	318	14	3.1	14	0.00	52	28	8.8	0.07
May 6–June 3	28	+10.0	194	20	6.2	13	.00	64	21	6.7	.07
June 4–July 1	28	+ 5.8	156	19	5.6	13	.00	69	24	6.3	.06
July 2–29	27	− 4.6	206	17	4.0	[a] 9.7	.00	56	28	9.7	.04
July 30–August 26	28	.....	276	.....	5.1	12	.00	47	24	9.1	.01
August 27–September 24	25	+ 3.5	323	15	5.3	14	.00	43	30	12	.07
September 26–October 28	30	.....	554	18	4.3	13	1.3	.....	40	10	.02
October 29–November 29	24	− 6.1	450	14	4.9	8.0	.00	39	32	12	.01
December 4–January 13	25	− .7	514	13	5.4	14	.00	45	33	12	.02
January 14–March 3	21	+ 2.3	437	13	5.7	15	.00	43	33	11	.02
March 4–April 6	25	.....	452	17	4.2	16	.00	.....	33	7.5	.03
April 7–May 5	21	+ 7.9	306	16	4.2	15	.00	49	27	6.5	.01
May 7–11	5	.....	289	15	5.2	14	.00	58	21	.....	.....
Mean	.....	4.8	344	16	4.9	13	.10	51	29	9.3	.04

[a] Sodium is 91 per cent and potassium is 12 per cent of this amount.

Monthly discharge, in second-feet, of Green River near Jensen or Vernal, Utah.

Month.	1903.	1904.	1906.	Mean.
January	.....	.....	.....	[a] 2,000
February	.....	[b] 3,880	.....	[a] 3,880
March	.....	3,550	[c] 7,340	5,440
April	.....	7,580	8,070	7,820
May	.....	20,400	19,400	19,900
June	.....	23,000	20,400	21,700
July	.....	9,480	9,230	9,360
August	.....	3,100	3,850	3,480
September	.....	1,210	3,080	2,140
October	.....	1,040	.....	1,040
November	[a] 1,290	745	.....	1,020
December	1,730	[a] 639	.....	[a] 1,180
The year	.....	.....	.....	6,580

[a] Approximate. [b] February 24–29. [c] March 13–31.

GUNNISON RIVER NEAR WHITEWATER, COLO.

Samples of water were collected from Gunnison River at a State bridge near Whitewater, Colo., from April 2 to October 31, 1905. A gaging station was established at the bridge by the United States Geological Survey April 10, 1902, and was discontinued October 31, 1906. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for the station have been published by the Survey in the following reports:

Bulletin: 140, p. 189.

Water-Supply Papers: 16, p. 140; 66, pp. 94–95; 85, pp. 42–44; 100, pp. 64–67; 133, pp. 162–164; 175, pp. 112–115; 211, pp. 89–90.

Monthly discharge data for Gunnison River at Grand Junction, Colo.,[a] 8 miles below Whitewater, have been published by the Survey as follows:

Reports: 19, IV, p. 405; 20, IV, p. 390; 21, IV, p. 278.
Water-Supply Paper, 74, p. 134.

Partial analyses, gage heights, and rates of discharge of water and solids for Gunnison River at State bridge, near Whitewater, Colo.

[Drainage area, 7,870 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905.									
Aprll 2, 3, 4, 5, 6, 7	Tr.	156	27	262	680	4.3	910	644	1,670
April 9, 10, 11, 12	6	128	18	1,300	446	5.3	2,030	7,110	2,440
April 16, 17, 18, 19, 20, 21, 22	0	125	14	536	340	5.6	2,430	3,510	2,230
April 23, 24, 25, 26, 27, 28, 29	0	112	9	1,320	280	6.6	3,900	13,900	2,950
April 30, May 1, 2, 3, 4, 5, 6	0	112	8	1,720	262	9.0	9,080	42,100	6,420
May 7, 8, 9, 10, 11, 12, 13	0	107	10	44	240	8.2	7,170	853	4,650
May 14, 15, 16, 17, 18, 19, 20	10	91	13	708	212	9.5	10,900	20,800	6,240
May 21, 22, 23, 24, 25, 26	0	94	9	1,150	288	12.4	21,100	65,500	16,400
May 28, 29, 30, June 1, 2, 3	0	90	8	362	182	11.7	18,100	17,700	8,890
June 4, 5, 6, 7, 8, 9, 10	0	112	39	880	250	13.5	26,000	61,700	17,500
June 11, 12, 13, 14, 15, 16, 17	0	96	21	392	240	12.1	19,600	20,800	12,700
June 18, 19, 20, 21, 22, 23, 24	0	92	14	232	202	9.7	11,000	6,900	6,000
June 26, 27, 28, 29, 30, July 1	0	71	15	148	202	8.3	7,350	2,940	4,010
July 2, 3, 4, 5, 6, 7, 8	0	88	13	32	286	6.7	4,230	366	3,270
July 9, 10, 11, 12, 14, 15	0	112	20	50	282	5.6	2,770	374	2,110
July 16, 17, 18, 19, 20, 21, 22	0	118	18	58	362	5.3	2,130	334	2,080
July 23, 25, 26, 27, 28, 29	0	135	24	206	476	4.8	1,640	913	2,110
July 30, 31, August 1, 3, 4	0	142	27	246	420	5.6	2,670	1,770	3,030
August 6, 7, 8, 9, 10, 11, 12	0	136	37	196	376	4.8	1,640	868	1,670
August 13, 14, 15, 16, 18, 19	0	140	26	66	528	4.3	1,240	221	1,770
August 20, 21, 22, 23, 24, 25, 26	0	131	19	60	586	3.8	821	133	1,300
August 27, 28, 29, 30, 31, September 1, 2	0	151	27	570	602	4.0	901	1,380	1,460
September 3, 4, 5, 6, 7, 8, 9	0	146	26	4,090	752	4.3	1,180	13,000	2,390
September 10, 11, 12, 13, 14, 15, 16	0	149	32	166	670	4.0	929	416	1,680
September 17, 18, 19, 20, 21, 22, 23	0	136	25	54	718	3.7	752	110	1,460
September 24, 25, 26, 27, 28, 29, 30	0	144	35	508	1,100	4.0	982	1,330	2,920
October 1, 2, 3, 4, 5, 6, 7	11	139	31	1,420	860	4.4	1,290	4,930	3,000
October 8, 9, 10, 11, 12, 13, 14	7	147	35	132	790	4.0	933	332	1,990
October 15, 16, 17, 18, 19, 20	6	159	38	48	904	4.1	998	129	2,440
October 22, 23, 24, 26, 27, 28	0	169	44	342	926	4.2	1,150	1,060	2,880
October 29, 30, 31	0	178	36	92	870	4.2	1,160	288	2,730

[a] See also First Ann. Rept. U. S. Reclamation Service, p. 144.

Relative amount of substances in solution in water from Gunnison River at State bridge, near Whitewater, Colo.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905.											
April 2–29	24	+3.0	438	13	5.0	12	0.00	32	40	4.6	0.10
April 30–May 26	27	−2.8	218	17	5.0	7.3	.00	54	32	5.0	.16
May 28–June 24	26	−1.4	199	18	4.7	8.0	.00	51	33	6.5	.14
June 26–July 22	26	.....	278	18	5.0	.....	.00	38	38	5.7	.16
July 23–August 19	24	+3.1	435	14	4.4	[a]12	.71	29	41	4.8	.10
August 20–September 16	28	+3.6	650	14	4.8	12	.00	24	48	4.3	.08
September 17–October 14	28	.....	916	14	4.6	11	.00	.....	48	4.0	.12
October 15–31	15	.....	930	.....	4.7	11	.00	.....	47	3.8	.24
Mean	.....	2.8	508	15	4.8	10	.09	38	41	4.8	.14

[a] Sodium is 98 per cent and potassium is 3.1 per cent of this amount.

Monthly discharge, in second-feet, of Gunnison River near Whitewater, Colo.

Month.	1897.[a]	1898.[a]	1899.[a]	1902.	1903.	1904.	1905.	1906.	Mean.
January	.....	.....	.....	.....	.....	724	.....	.....	724
February	.....	.....	.....	.....	.....	774	.....	.....	774
March	.....	.....	.....	.....	.....	648	.....	.....	648
April	.....	.....	3,550	1,220	2,260	2,250	2,490	4,590	2,730
May	[b]16,300	5,320	10,300	7,770	8,160	5,620	12,700	14,800	10,100
June	12,300	8,850	12,400	3,280	12,500	4,600	16,800	14,400	10,600
July	4,410	2,540	4,350	570	5,130	1,320	2,780	4,710	3,230
August	991	689	1,920	610	1,310	1,640	1,430	2,080	1,330
September	482	479	875	667	1,280	1,100	962	1,680	941
October	1,600	533	.....	504	890	1,300	1,100	1,690	1,090
November	742	497	.....	.....	844	.....	.....	.....	694
December	[b]458	.....	.....	.....	810	.....	.....	.....	634
The year	.....	.....	.....	.....	.....	.....	.....	.....	2,790

[a] At Grand Junction, Colo. [b] Approximate.

HONDO RIVER NEAR ROSWELL, N. MEX.

Samples of water were collected from Hondo River at the United States Reclamation Service reservoir near Roswell, N. Mex., from March 26 to August 4, 1905. A gaging station was established at the reservoir by the United States Geological Survey March 9, 1903, and was discontinued March 31, 1908. Stream-flow data, including gage heights and estimates of discharge, for the station have been published by the Survey in the following reports:

Water-Supply Papers: 99, pp. 362–363; 132, pp. 119–121; 174, pp. 118–120; 210. pp. 100–101; 248, pp. 137–138.

Partial analyses, gage heights, and rates of discharge of water and solids for Hondo River at reservoir near Roswell, N. Mex.

[Drainage area, 1,040 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905.									
March 26, 27, 28, 29, 30, 31	6	163	44	1,830	864	3.1	61	300	142
April 2, 3, 4, 5, 6	12	155	52	1,340	914	2.5	46	167	114
April 9, 10, 11, 12, 13, 15	10	145	41	2,080	864	2.3	40	225	93
April 16, 17, 18, 19, 21, 22	7	155	39	2,550	750	2.6	45	310	91
April 23, 24, 25, 26, 27, 28, 29	0	144	36	11,000	614	6.9	831	24,700	1,380
April 30, May 1, 2, 3, 4, 5, 6	0	135	33	5,740	546	7.5	942	14,600	1,390
May 7, 8, 9, 10, 11, 12, 13	6	125	36	1,890	712	4.8	380	1,940	731
May 14, 15, 16, 17, 18, 19, 20	7	137	29	1,780	720	3.2	94	450	183
May 21, 22, 23, 24, 25, 26, 27	5	120	32	10,700	842	3.0	77	2,210	175
May 28, 29, 30, 31, June 1, 2, 3	6	125	30	5,530	638	1.9	19	283	33
June 4, 5, 6, 10	14	113	38	14,900	698	3.4	266	10,700	501
June 11, 12, 13, 14, 15, 16, 17	0	146	97	13,200	978	6.4	547	19,500	1,440
June 18, 19, 20, 21, 22, 23	0	154	48	1,640	986	4.8	176	781	469
July 7	.....	.....	.....	.....	[a] 2,140	.....	.....	.....	.....
July 8, 24, 25, 26, 27, 28, 29	0	142	39	10,700	632	8.7	825	23,900	1,410
July 30, 31, August 1, 2, 3, 4	0	164	26	22,200	698	5.2	423	25,400	798

[a] From pool; no water flowing.

Relative amount of substances in solution in water from Hondo River at reservoir near Roswell, N. Mex.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905.											
March 26–April 22	23	.....	988	.....	3.6	4.4	1.1	16	40	4.4	0.35
April 23–May 20	28	.....	660	18	3.8	5.0	.....	.....	41	6.1	.13
May 21–June 17	25	+0.6	739	18	4.7	4.7	.00	19	49	5.0	.03
June 18–August 4	18	− .9	740	20	3.4	6.1	.00	23	50	4.3	.09
Mean	.....	.8	782	19	3.9	5.0	.37	19	45	5.0	.15

Monthly discharge, in second-feet, of Hondo River at reservoir near Roswell, N. Mex.

Month.	1906.	1907.	Mean.
January	67	166	116
February	22	23	22
March	3	0	2
April	24	0	12
May	0	0	0
June	0	1	0
July	0	4	2
August	[a] 10	20	15
September	5	8	6
October	7	28	18
November	14	55	34
December	7	14	10
Mean	13	27	20

[a] Eight days only.

LINK RIVER NEAR KLAMATH FALLS, OREG.

Samples of water were collected from Link River at a county bridge near Klamath Falls, Oreg., from June 15, 1905, to November 12, 1906. A gaging station was established at the bridge by the United States Geological Survey May 15, 1904. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for the station have been published by the Survey in the following reports: [a]

Water-Supply Papers: 134, pp. 191–192; 177, pp. 226–229; 213, pp. 176–177; 251, pp. 305–309.

Relative amounts of substances in solution in water from Link River at county bridge near Klamath Falls, Oreg.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905–6.											
June 15–December 28	13	+12.0	138	8.7	3.7	17	0.00	51	9.4	3.0	3.2
July 2	1	+13.2	101	12	5.8	19	.00	64	12	4.9	.04
July 16	1	.....	110	.....	.....	17	.00	59	8.8	6.6	.04
August 1	1	.....	128	11	5.0	17	.00	.....	10	5.7	.03
August 15	1	+15.6	107	11	5.8	18	.00	61	8.9	4.6	.04
September 15	1	+14.0	103	12	5.9	18	.00	64	8.7	7.1	.04
October 16	1	+ 3.4	96	11	6.8	26	.00	75	8.5	25	.04
November 12	1	− 5.8	96	14	4.8	17	.00	75	9.3	21	.04
Mean	.....	10.7	111	11	5.4	19	.00	64	9.4	9.7	.43

Partial sanitary analyses of water from Link River at county bridge near Klamath Falls, Oreg.

[Milligrams per liter.]

Dates.	Nitrogen as—				Oxygen consumed.
	Free ammonia.	Albuminoid ammonia.	Nitrites.	Nitrates.	
1906.					
January 11	0.020	0.105	Trace.	0.02	7.40
February 7	.070	.240	0.000	.05	2.99
February 21	.116	.180	.050	.05	2.39
March 5	.008	.220	.000	.05	3.06
March 16	.142	.176	.004	.05	2.47
April 2	.120	.320	.002	.03	3.18
April 18	.164	.400	.006	.02	5.61
May 5	.004	.340	.000	.....	5.37
May 15	.034	.360	.040	.....	6.29
June 1	.176	.440	.002	.....	6.85
June 15	.....	.....	.010	.....	7.64

[a] See also Third Ann. Rept. U. S. Reclamation Service, p. 205; Fourth, p. 87.

Partial analyses, gage heights, and rates of discharge of water and solids for Link River at county bridge near Klamath Falls, Oreg.

[Drainage area, 3,700 square miles.]

Dates.	Analysis (milligrams per liter).										Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Calcium radicle (Ca).	Magnesium radicle (Mg).	Sodium and potassium radicles ($Na+\frac{3}{4}K$).	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Sulphate radicle (SO_4).	Chlorine radicle (Cl).	Nitrate radicle (NO_3).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–6.														
June 15, 16, 17	.....	.....	.....	0	80	.....	29	.....	32	214	3.6	1,970	170	1,140
June 19 to 24	.....	.....	.....	9.2	66	.....	8	.....	48	88	3.5	1,850	240	440
June 20 [a]	.....	.....	.....	.....	.....	.....	.....	.....	28	102	3.6	.....	.....	.....
June 20 [b]	.....	.....	.....	.....	.....	.....	.....	.....	0	116	3.6	.....	.....	.....
June 20 [c]	.....	.....	.....	.....	.....	.....	.....	.....	0	134	3.6	.....	.....	.....
December 25, 26, 27, 28	.....	.....	.....	0	69	.....	11	.....	34	116	3.3	1,620	149	507
January 11	.....	.....	.....	0	77	.....	6	.09	.....	123	3.5	1,800	.....	598
February 7	.....	.....	.....	0	54	.....	3	.22	30	114	3.6	1,920	154	590
February 21	.....	.....	.....	0	64	.....	5	.22	42	94	3.7	2,040	231	518
March 5	.....	.....	.....	0	64	.....	5	.22	16	124	3.7	2,040	88	683
March 16	.....	.....	.....	0	64	.....	5	.22	36	100	3.9	2,310	225	624
April 2	.....	.....	.....	0	51	.....	5	.13	30	98	4.2	2,740	222	725
April 18	.....	.....	.....	0	54	.....	10	.09	46	82	4.8	3,770	468	835
July 2	12	6	19	0	65	12	5	.04	33	101	4.4	2,980	265	814
July 16	.....	.....	19	0	65	10	7	.04	42	110	4.0	2,520	286	748
August 1	14	6	22	0	.....	13	7	.04	30	128	3.5	1,800	143	624
August 15	12	6	19	0	65	10	5	.04	23	107	3.2	1,440	89	417
September 15	12	6	19	0	65	9	7	.04	31	103	2.8	1,150	96	320
October 16	11	6	25	0	72	8	24	.04	.....	96	2.8	1,180	.....	306
November 12	13	5	16	0	72	9	20	.04	.....	96	3.1	1,390	.....	360

[a] 90 feet from initial point for gaging. [b] 160 feet from initial point for gaging. [c] 230 feet from initial point for gaging.

Monthly discharge, in second-feet, of Link River near Klamath Falls, Oreg.

Month.	1904.	1905.	1906.	1907.	1908.	Mean.
January	.....	2,620	1,950	2,190	2,660	2,360
February	.....	3,100	1,990	3,530	2,890	2,880
March	.....	3,090	2,320	4,650	2,730	3,200
April	.....	3,110	3,520	5,630	2,990	3,810
May	[a] 8,640	2,600	4,080	5,090	2,620	4,610
June	6,740	2,090	3,620	4,020	2,060	3,690
July	4,120	1,360	2,490	2,470	1,470	2,380
August	2,340	1,050	1,470	1,570	1,040	1,490
September	1,660	1,030	1,190	1,410	900	1,240
October	1,690	1,160	1,200	1,460	1,350	1,370
November	1,840	1,330	1,460	1,630	1,770	1,610
December	2,180	1,590	1,740	1,970	1,940	1,880
The year	.....	2,000	2,250	2,970	2,040	2,540

[a] May 15 to 31.

LITTLE COLORADO RIVER NEAR HOLBROOK, ARIZ.

Samples of water were collected from Little Colorado River at a county bridge near Holbrook, Ariz., from December 31, 1905, to January 11, 1906. A gaging station was established at the bridge March 17, 1905, and was discontinued December 31, 1908. Stream-flow data, including gage heights and estimates of discharge, for the station have been published by the Survey in the following reports:

Water-Supply Papers: 175, pp. 149–151; 211, pp. 107–109; 249, pp. 167–169.

Partial analyses, gage heights and rates of discharge of water and solids for Little Colorado River at county bridge near Holbrook, Ariz.

[Drainage area, 17,630 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–6.									
December 31	18	230	163	244	792	3.4	205	135	439
January 1	20	238	163	140	888	3.4	305	115	731
January 5	20	236	201	156	928	3.5	330	139	826
January 10	0	259	197	188	792	3.6	370	187	791
January 11	0	270	210	120	824	3.6	370	120	823

Monthly discharge, in second-feet, of Little Colorado River near Holbrook, Ariz.

Month.	1905.	1906.	1907.	Mean.
January	.....	452	276	364
February	.....	170	176	173
March	[a] 863	621	444	643
April	915	245	401	520
May	[b] 353	54	.....	204
June	83	4	.....	44
July	68	25	.....	46
August	163	72	.....	118
September	302	69	.....	350
October	51	27	.....	39
November	1,160	11	.....	586
December	113	181	.....	147
The year	.....	161	.....	269

[a] March 17–31. [b] Approximate.

LITTLE COLORADO RIVER NEAR WOODRUFF, ARIZ.

Samples of water were collected from Little Colorado River at a road crossing near Woodruff, Ariz., from April 15, 1905, to April 3, 1906. A gaging station was established at the crossing March 16, 1905. Stream-flow data, including gage heights and estimates of discharge, for the station have been published by the Survey in the following reports:

Water-Supply Papers: 175, pp. 145–148; 211, pp. 104–107; 249, pp. 165–167.

Partial analyses, gage heights, and rates of discharge of water and solids for Little Colorado River at road crossing near Woodruff, Ariz.

[Drainage area, 6,000 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–6.									
April 15, 18, 21	0	150	62	16,300	506	6.9	434	19,100	594
April 26, 30, May 3, 8, 12, 21	10	149	119	20,700	750	10.9	.....	.....	.....
May 30, June 3, 6, 11, 16, 20	7	178	172	2,580	906	3.3	.....	.....	.....
June 23, 27, 30, July 3, 8, 12	0	181	133	624	750	2.1	.....	.....	.....
July 15, 21, 26, 30, August 3	0	174	40	10,300	388	2.9	.....	.....	.....
August 6, 9, 11, 13, 18	0	142	34	3,560	294	0.5	61	589	48
August 21, 25, 27, 29, September 1, 8	0	174	143	19,700	886	1.0	74	3,940	179
September 11, 14, 17, 20, 22, 25	0	170	80	3,230	476	1.0	160	1,400	206
September 28, October 1, 4, 6, 10, 12, 16	6	164	112	2,130	628	0.8	43	247	73
October 20, 26, 30, November 5, 9	0	178	124	2,810	610	1.2	67	508	110
November 12, 14, 21, 22, 23, 25	0	169	123	11,800	626	1.2	52	1,650	88
November 29, December 1, 4, 8, 13, 14	0	182	77	3,540	578	1.8	329	3,150	513
December 16, 17, 18, 19, 20, 27	0	234	116	324	798	0.5	30	26	65
January 1, 2, 5, 6	0	285	109	96	670	0.3	25	6	45
January 9, 10, 11, 12, 13	0	274	108	32	658	0.3	25	2	44
January 14, 15, 16, 17, 18, 19	0	195	72	11,700	474	3.2	211	6,670	270
January 20, 21, 22, 23, 24, 25, 26	0	148	69	3,170	408	1.6	124	1,060	137
January 28, 29, 30, 31, February 1, 2, 3	0	214	134	10,500	754	1.0	115	3,270	234
February 4, 5, 6, 7, 8, 9	0	165	82	18,800	582	1.5	228	11,600	358
February 10, 11, 12, 13, 14, 15, 16, 17	0	138	57	6,740	364	1.3	193	3,510	190
February 19, 20, 23, 24	0	119	99	1,520	290	0.9	146	600	114
February 26, 27, 28, March 1, 2, 3	6	135	82	1,950	472	0.6	138	727	176
March 5, 6, 7, 8, 9	0	234	100	3,580	608	0.5	101	923	166
March 10, 12, 13, 14, 15, 16, 17	0	157	55	5,540	374	5.0	820	12,300	829
March 19, 20, 21, 22, 23, 24	11	108	74	7,080	410	2.3	239	4,570	264
March 25, 26, 29, 30, 31	0	166	102	15,200	544	3.4	488	20,100	716
April, 1, 2, 3	0	195	77	10,400	630	2.3	236	6,600	402

Relative amount of substances in solution in water from Little Colorado River at road crossing near Woodruff, Ariz.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905–6.											
April 15–July 12	21	.....	754	14	3.2	19	0.00	.....	34	18	0.03
July 15–September 25	22	+4.2	558	13	2.9	[a] 18	.00	32	31	14	.02
September 28–December 14	24	− .7	640	9.5	3.2	18	.00	28	29	17	.....
December 16–January 19	21	.....	573	11	3.5	.....	.00	.....	28	17	.02
January 20–February 17	28	−6.1	504	8.5	2.2	22	.00	32	35	18	.02
February 19–March 17	22	+ .7	463	13	2.8	18	.00	40	25	17	.02
March 19–April 3	14	.....	504	.....	2.8	19	.00	41	26	15	.01
Mean	.....	2.9	571	12	2.9	19	.00	35	30	17	.02

[a] Sodium is 92 per cent and potassium is 11 per cent of this amount.

Monthly discharge, in second-feet, of Little Colorado River near Woodruff, Ariz.

Month.	1905.	1906.	1907.	Mean.
January	.....	96	168	132
February	.....	172	117	144
March	[a] 584	445	210	413
April	789	323	140	417
May	.....	57	.....	57
June	.....	4	.....	4
July	.....	15	23	19
August	58	67	325	150
September	159	15	218	131
October	20	12	133	55
November	543	7	78	209
December	37	202	16	85
The year	.....	118	.....	151

[a] March 16 to 31.

MALHEUR RIVER NEAR VALE, OREG.

Samples of water were collected from Malheur River at a highway bridge near Vale, Oreg., from March 26 to December 4, 1905. A gaging station was established at the bridge by the United States Geological Survey May 20, 1903, and gagings had been made at intervals since 1890. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for the station have been published by the Survey in the following reports:

Annual Reports: 11, II, pp. 88, 106; 12, II, pp. 344, 358, 361; 13, III, pp. 98–99; 18, IV, pp. 348–350; 20, IV, p. 62.

Bulletins: 92, p. 140; 131, p. 68; 140, pp. 242–243.

Water-Supply Papers: 11, p. 83; 16, p. 169; 100, pp. 424–427; 135, pp. 206–208; 178, pp. 126–129; 214, pp. 101–102; 252, pp. 257–259.

Partial analyses, gage heights, and rates of discharge of water and solids for Malheur River at highway bridge near Vale, Oreg.

[Drainage area, 4,860 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905.									
March 26, 27, 28, 29, 30, 31	4	99	13	105	195	6.1	1,230	349	647
April 2, 3, 4, 5, 6, 7	0	99	8	220	162	6.1	1,250	742	546
April 9, 10, 11, 12, 13, 14	0	90	6	96	166	6.0	1,090	282	488
April 17, 18, 20, 21	0	94	10	36	162	5.5	708	69	310
April 23, 24, 25, 29	0	106	9	50	200	5.3	600	81	324
April 26	0	131	32	70	240	5.3	575	109	373
April 30, May 1, 2, 3, 5	0	112	11	34	184	5.1	436	40	217
May 11, 12, 13	6	132	10	78	220	4.5	206	43	117
May 14, 15, 16, 18, 19, 20	0	165	16	26	278	4.3	154	11	115
May 17	0	181	18	30	288	4.3	153	12	118
May 21, 22, 23	6	180	29	6	344	4.2	126	2	117
May 31, June 1, 2, 3	0	169	14	840	252	4.5	250	567	170
June 4, 5, 6, 7, 8, 9, 10	9	149	16	1,670	256	4.8	370	1,670	255
June 11, 12, 13, 15, 16, 17	0	165	14	412	264	4.8	310	345	221
June 18, 19, 20, 21, 22, 23	0	189	29	306	312	4.4	170	141	143
June 25, 26, 27, 28, 29, 30, July 1	0	207	29	52	366	4.2	122	17	120
July 2, 3, 4, 5, 6, 8, 9	0	170	21	30	390	3.9	75	6	78
July 10, 11, 12, 13, 14, 15	9	244	32	72	390	3.6	24	5	25
July 16, 17, 18, 19, 20, 21, 22	7	240	37	90	400	3.7	31	8	33
July 23, 24, 25, 26, 27, 28, 29	9	242	36	24	498	3.6	21	1	28
July 30, 31, August 2, 3, 4, 5	12	229	37	54	436	3.6	19	3	22
August 6, 7, 8, 9, 10, 11, 12	0	279	40	62	442	3.6	16	3	19
August 13, 14, 15, 16, 17, 18, 19	0	292	44	24	462	3.6	12	1	15
August 20, 21, 22, 23, 30, 31, September 1	0	290	40	18	486	3.6	16	1	21
September 3, 6, 7, 8, 9	43	186	42	68	486	3.6	19	3	25
September 10, 11, 17, 18, 19, 20, 21	0	236	35	36	406	3.7	35	3	38
September 22, 23, 24, 25, 26, 27, October 7	15	195	29	48	398	3.8	49	6	53
October 8, 9, 10, 11, 12, 13, 14	0	196	27	18	368	3.9	57	3	57
October 15, 16, 17, 18, 19, 20, 21	0	186	23	20	340	4.0	85	5	78
October 22, 23, 24, November 6, 7, 8, 9	0	178	20	44	318	4.1	105	12	90
November 10, 11, 12, 13, 14, 15, 16	0	166	17	70	254	4.2	115	22	79
November 17, 18, 19, 20	0	165	21	106	336	4.2	127	36	115
November 26, 27, 30, December 1, 3, 4	0	155	22	10	340	4.3	150	4	138

Relative amount of substances in solution in water from Malheur River at highway bridge near Vale, Oreg.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{2}{3}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905–6.											
March 26–April 21	22	+ 1.4	182	8.8	4.2	14	0.00	59	12	4.6	0.05
April 23–May 20	18	− 3.9	210	11	4.3	14	.00	70	16	6.2	.04
May 21–June 17	20	− 3.4	254	10	4.3	16	.00	68	17	8.3	.05
June 18–July 15	26	+ .7	342	11	5.0	18	2.3	61	19	7.6	.01
July 16–August 12	27	.....	424	.....	4.7	[a]17	.00	63	19	8.0	.03
August 13–September 21	26	.....	514	.....	4.1	18	.00	.....	16	12	.01
September 22–November 9	28	− 1.7	322	13	4.7	16	.00	62	21	8.7	.01
November 10–December 4	17	+ 2.8	283	11	4.2	16	.00	56	19	8.1	.03
Mean	.....	2.3	316	11	4.4	16	.29	63	17	7.9	.03

[a] Sodium is 90 per cent and potassium is 13 per cent of this amount.

Monthly discharge, in second-feet, of Malheur River near Vale, Oreg.

Month.	1890.	1891.	1895.	1896.	1903.	1904.	1905.	1906.	1907.	1908.	Mean.
January	.....	88	277	[a] 300	.....	[a] 236	503	174	287	.....	266
February	.....	319	347	331	.....	[a] 3,100	642	311	2,190	.....	1,030
March	2,910	703	650	.....	.....	[a] 3,460	1,620	1,920	1,960	.....	1,890
April	2,770	511	851	[b] 642	.....	5,520	898	4,550	.....	.....	2,250
May	1,630	217	361	1,600	[c] 274	2,030	235	862	.....	.....	901
June	254	78	139	1,600	203	533	244	589	.....	177	424
July	43	30	19	185	58	146	40	50	.....	77	72
August	17	26	12	33	19	52	16	9	.....	47	26
September	15	23	89	83	42	50	33	26	.....	65	47
October	44	.....	129	.....	84	144	77	50	.....	100	90
November	118	.....	161	.....	192	182	119	89	.....	126	141
December	83	.....	175	.....	175	188	155	138	.....	135	150
The year	.....	.....	268	.....	.....	1,300	381	731	.....	.....	607

[a] Approximate. [b] April 26–30. [c] May 20–31.

MILK RIVER NEAR HAVRE, MONT.

Samples of water were collected from Milk River at a highway bridge near Havre, Mont., from April 7, 1905, to April 14, 1906. A gaging station was established at the bridge by the United States Geological Survey May 15, 1898. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for the station have been published by the Survey in the following reports: [a]

Annual Reports: 20, IV, pp. 53, 189, 245–246; 21, IV, p. 189; 22, IV, p. 288.
Water-Supply Papers: 27, pp. 68–69, 72, 75–76; 37, pp. 209–210; 39, p. 447; 49, p. 267; 52, p. 516; 66, pp. 15–16, 170; 75, p. 122; 84, pp. 28–31; 99, pp. 108–111; 130, pp. 95–98; 172, pp. 57–59; 208, pp. 43–45; 246, pp. 109–112.

Partial analyses, gage heights, and rates of discharge of water and solids for Milk River at highway bridge near Havre, Mont.

[Drainage area, 7,300 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–6.									
April 7	.....	.....	.....	186	528	3.4	55	28	78
April 9, 10, 11, 12, 13, 14	21	304	9	130	512	3.3	49	17	68
April 16, 17, 18, 19, 21, 22	14	321	27	154	562	3.4	58	24	88
April 24, 25, May 9, 10, 11, 12, 13	30	279	25	154	474	3.5	61	25	78
May 14, 23, 24, 25, 26, 27	0	293	25	116	430	3.6	71	22	82
May 28, 29, 30, 31, June 13	21	276	20	56	454	3.5	53	8	65
June 4, 5, 6, 7, 8, 9	29	243	48	62	436	3.4	40	7	47
June 12, 14, 15, 16	12	292	35	148	452	3.2	23	9	28
June 18, 27, 29, 30, July 1	5	242	14	6,630	544	3.5	62	1,110	91
July 3, 5, 6, 8	0	299	20	974	562	3.5	55	145	84
July 7, 9, 10, 11, 12, 14, 15	15	249	47	100	580	3.3	36	10	56
July 16, 17, 18, 22	23	325	29	106	626	3.0	8	2	14
July 23, 25, 26, 29	42	307	40	7,420	778	3.3	92	1,840	193
July 30, August 3	0	219	92	17,400	690	3.8	103	4,850	192
August 6, 7, 8, 9, 10, 11, 12	0	241	23	5,450	584	3.3	37	545	58
August 13, 14, 15, 16, 22, 23	0	341	30	136	564	2.7	2	1	3
August 27, September 6, 15, 17, 21, 23	0	535	40	70	976	.....	.....	.....	.....
October 28, 30 31, November 1, 2, 3, 4	10	599	63	0	1,260	.....	.....	.....	.....
November 17, 18, 19, 20, 21, 22	0	481	36	66	814	.....	.....	.....	.....
April 3, 4, 5, 6, 7	0	207	24	1,600	374	4.1	121	523	122
April 9, 10, 11, 12, 13, 14	0	211	15	1,000	360	4.2	132	357	128

[a] See also Second Ann. Rept. U. S. Reclamation Service, pp. 339–340; Fourth, p. 181.

Relative amount of substances in solution in water from Milk River at highway bridge near Havre, Mont.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium (Na+K).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905–6.											
April 9–May 27	25	−2.0	506	10	5.9	15	2.2	63	25	2.6	0.69
May 28–July 1	21	+1.1	500	8.2	5.4	21	1.6	59	32	2.4	.06
July 3–29	19	.....	546	7.9	4.8	[a] 17	.00	61	30	.....	.06
July 30–September 23	24	+4.8	730	7.4	3.1	26	.00	50	35	3.0	.02
October 28–November 22	13	−2.1	972	5.9	4.5	22	.00	51	32	5.5	.13
April 3–14	11	−1.8	369	7.1	4.9	21	.00	68	26	3.0	.00
Mean	.....	2.4	604	7.8	4.8	20	.63	59	30	3.3	.16

[a] Sodium is 93 per cent and potassium is 8.8 per cent of this amount.

Monthly discharge, in second-feet, of Milk River near Havre, Mont.

Month.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	Mean.
January	.....	[a] 430	[a] 100	[a] 50	180	[a] 200	[a] 90	[a] 5	0	0	.....	117
February	.....	[a] 600	[a] 100	[a] 100	[a] 208	[a] 200	[a] 75	[a] 5	[a] 5	[a] 800	.....	233
March	.....	[a] 500	[a] 150	[a] 600	249	[a] 240	[a] 75	[a] 40	[a] 40	845	212	295
April	.....	1,360	[a] 394	205	196	996	1,740	59	95	1,210	295	655
May	[a] 1,400	1,010	435	648	1,080	1,080	373	62	119	458	330	636
June	1,350	[a] 940	154	553	1,480	975	278	35	935	822	2,190	883
July	168	[a] 241	43	184	2,040	445	44	54	101	397	527	386
August	113	[a] 196	40	28	377	378	5	25	5	62	177	128
September	53	131	76	56	297	164	3	0	3	127	124	94
October	88	94	186	82	309	138	19	0	2	82	178	107
November	[a] 100	[a] 190	[a] 114	80	[a] 300	[a] 115	35	0	1	72	186	108
December	113	[a] 150	[a] 50	[a] 100	[a] 300	[a] 147	[a] 25	0	0	[a] 60	.....	94
The year	.....	487	154	224	586	423	230	24	109	411	.....	311

[a] Approximate.

NOTE.—Data for 1898–1903 from Second Ann. Rept. U. S. Reclamation Service, pp. 340–341, estimates for ice periods being included.

MISSOURI RIVER NEAR WILLISTON, N. DAK.

Samples of water were collected from Missouri River at Bakers ferry, near Williston, N. Dak., on August 14, 1905. A gaging station was established at the ferry by the United States Geological Survey April 24, 1905. Stream-flow data, including gage heights and estimates of discharge, have been published by the Survey in the following reports:

Water-Supply Papers: 176, pp. 28–29; 208, p. 20; 246, p. 41–42.

Suspended matter and dissolved solids in water of Missouri River at Bakers ferry, near Williston, N. Dak., on August 14, 1905.

[Drainage area, 155,000 square miles.]

Distance from left bank (feet).	Depth of river (feet).	Velocity (feet per second.)	Solids (milligrams per liter).	
			Suspended matter.	Dissolved solids.
820	9.5	2.38	994	300
770	9.7	3.16	1,010	304
620	15.0	3.61	964	310
620	15.0	[a] 3.25	938	324
620	15.0	[b] 2.75	938	328
550	15.0	2.58	964	318
530	14.0	2.63	924	344
530	14.0	[a] 1.28	940	350
530	14.0	[b] 3.07	864	338
440	9.6	3.02	998	310
405	8.0	2.43	1,010	282
340	5.0	2.17	968	310
320	4.4	2.22	968	306
258	5.0	1.7	1,030	262
230	5.2	1.24	956	310
135	1.4	1.13	962	292
85	5.8	1.4	996	322
30	3.8	.99	942	306

[a] Sample taken and velocity measured at bottom.
[b] Sample taken and velocity measured at surface.

NOTE.—The river at about mean stage; gage height, 6.8 feet; area of cross section, 5,925 square feet; mean velocity, 2.51 feet per second; discharge, 14,880 second-feet; mean suspended matter, 978 milligrams per liter, or 39,300 tons per day; mean dissolved solids, 305 milligrams per liter, or 12,300 tons per day. Samples taken and velocity measured at .6 depth, except as otherwise noted.

Monthly discharge, in second-feet, of Missouri River near Williston, N. Dak.

Month.	1905.	1906.	1907.	Mean.
March	.....	.....	77,900	77,900
April	.....	.....	67,500	67,500
May	[a] 30,200	[b] 82,800	[d] 50,100	54,400
June	68,100	93,600	.....	53,900
July	54,900	52,700	.....	53,800
August	19,400	25,200	.....	22,300
September	7,100	15,400	.....	11,250
October	7,700	8,840	.....	8,270
November	8,060	[c] 10,100	.....	9,080

[a] May 23–31. [b] May 26–31. [c] November 1–24. [d] May 1–22.

NORTH FORK OF RED RIVER NEAR GRANITE, OKLA.

Samples of water were collected from North Fork of Red River at a railroad bridge near Granite, Okla., from April 12, 1905, to March 16, 1907. A gaging station was established at the bridge by the United States Geological Survey June 23, 1903, and was discontinued March 20, 1908. Stream-flow data, including gage heights and estimates of discharge, have been published by the Survey in the following reports:[a]

Water-Supply Papers: 99, pp. 319–320; 131, pp. 182–183; 173, pp. 73–75; 209, pp. 51–54; 247, pp. 89–92.

[a] See also Third Ann. Rept. U. S. Reclamation Service, p. 460.

Partial analyses, gage heights, and rates of discharge of water and solids for North Fork of Red River at railroad bridge near Granite, Okla.

[Drainage area, 2,210 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–1907.									
April 12	------	------	------	544	1,250	5.8	135	198	455
April 13, 14, 15, 16, 17, 18	8	191	388	116	1,920	5.4	33	10	171
April 26	------	------	------	13,600	808	8.1	5,720	210,000	12,500
May 15, 16, 17, 18, 19, 20	17	141	202	1,250	1,110	5.5	26	88	78
June 4, 5, 6, 8, 9, 10	16	156	190	1,670	1,100	6.1	337	1,510	996
June 9	------	------	------	2,830	1,050	6.4	650	4,980	1,840
June 11, 12, 13, 14, 15, 16, 17	0	188	245	696	1,300	6.0	233	438	818
June 18, 19, 20, 22, 23, 24	0	182	426	122	1,990	5.7	77	25	413
June 26, 27, 28, 29, 30, July 1	0	149	365	304	1,790	5.7	52	43	251
July 7, 29, 30	8	133	289	462	1,440	5.6	63	78	245
August 2, 3, 5, 6, 8, 9	0	193	540	0	2,240	5.8	111	0	670
August 21, 22, 24, 26, 29, 30, September 2	6	150	259	158	1,440	5.5	49	21	191
September 8, 9, 10, 13, 14, 15, 16	0	129	157	3,670	890	6.7	675	6,690	1,620
September 24, 27, 30, October 1, 2, 3, 4	10	255	211	1,210	1,170	5.0	1	3	3
October 5, 17, 18, 20, 21, 30, November 1	2	283	192	30	1,100	4.9	0	0	0
October 31, November 2, 3, 4	14	254	183	180	1,050	4.9	0	0	0
November 5, 8, 10, 11	0	186	268	840	1,490	5.7	206	467	828
November 12, 14, 15, 18	0	177	276	1,820	1,460	6.0	120	591	472
November 23, 24, 25, 26, 29, 30	0	182	236	5,570	1,200	6.7	628	9,440	2,040
December 3, 4, 5	0	224	324	594	1,570	5.8	94	151	399
December 10	6	185	373	568	1,660	5.8	49	75	219
December 13	6	191	317	440	1,560	6.0	60	71	253
December 14	6	191	359	1,420	1,440	6.0	68	261	264
December 15	0	185	352	996	1,640	6.4	160	430	706
December 16	0	185	296	1,170	1,340	6.2	92	290	332
December 17	6	205	289	944	1,320	6.1	80	203	285
December 19	9	219	333	572	1,670	6.0	68	105	306
December 20	0	215	318	560	1,600	6.0	68	103	294
December 21	0	214	318	568	1,640	6.0	60	92	266
December 22	18	164	305	612	1,570	6.1	80	132	338
December 23	0	223	354	468	1,710	6.2	93	118	430
December 26	13	198	326	728	1,710	6.2	117	230	541
December 28	0	237	338	452	1,640	6.1	80	93	355
January 4	22	176	370	584	1,800	6.2	73	115	355
January 5	0	227	411	812	1,930	6.4	113	248	588
January 6	0	228	376	772	1,800	6.2	73	153	356
January 8	23	186	367	652	1,780	6.2	73	129	354
January 9	13	226	405	336	1,950	6.1	58	53	306
January 11	0	190	402	340	1,960	6.2	65	60	343
January 12	0	193	376	368	1,820	6.2	64	64	314
January 13	0	234	393	252	1,920	6.0	52	35	270
January 14	0	227	432	280	2,050	6.3	82	62	455
January 15	0	211	341	548	1,680	6.2	73	108	330
January 16	0	224	383	284	1,770	6.1	58	44	278
January 17	0	212	367	180	1,840	6.1	58	28	278
January 18	13	172	370	76	2,000	6.1	58	12	313
January 19	0	210	364	240	1,760	6.1	58	38	276
January 20	0	210	363	204	1,820	6.1	58	32	285
January 21	0	224	411	204	2,040	6.0	52	29	287
January 22	0	248	523	80	2,360	6.0	47	10	300
January 23	0	267	524	120	2,440	5.8	22	7	145
January 24	0	257	465	0	2,240	5.8	22	0	133
January 25	0	220	479	192	2,210	5.9	38	20	227
January 28	0	227	465	132	2,210	5.9	38	14	227
February 1	0	194	409	16	2,000	6.0	46	2	248
February 2	25	168	434	44	2,090	6.0	46	5	260
February 3	0	203	424	60	2,070	6.0	38	6	212
February 5	0	235	503	0	2,520	5.8	20	0	136
February 7	16	255	570	80	2,560	5.9	32	7	222
February 8	0	277	550	0	2,610	5.8	22	0	155
February 9	0	257	508	0	2,530	5.8	22	0	150
February 10	0	264	508	0	2,520	5.8	22	0	150
February 14	0	210	423	556	2,100	6.4	101	151	574
February 15	0	212	423	1,120	1,940	6.5	142	432	746
February 16	0	266	393	240	2,060	6.3	91	59	504

Partial analyses, gage heights, and rates of discharge of water and solids for North Fork of Red River at railroad bridge near Granite, Okla.—Continued.

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–1907.									
February 17	0	224	283	328	1,560	6.2	65	58	274
February 18	0	217	302	300	1,550	6.1	58	47	242
February 19	0	224	329	220	1,680	6.0	51	30	231
February 20	0	212	370	300	1,530	6.3	91	74	375
February 21	0	233	309	944	1,660	6.1	58	148	259
February 22	0	201	290	804	1,430	6.0	44	96	170
February 23	0	242	307	584	1,490	5.9	37	58	149
February 24	0	200	352	452	1,660	5.9	37	45	165
February 25	0	202	377	360	1,810	5.9	37	36	181
February 26	0	190	402	368	1,860	5.8	26	26	131
February 28	0	213	489	228	2,220	5.8	26	16	156
March 1	0	214	528	316	2,320	5.7	18	15	112
March 2	0	219	503	168	2,400	5.7	18	8	117
March 2	0	265	275	592	1,640	5.7	18	29	80
March 3	0	281	271	588	1,340	5.4	2	3	7
March 4	0	236	528	72	2,670	5.6	13	3	94
March 5	0	217	600	128	2,760	5.6	10	3	75
March 6	0	223	567	44	2,680	5.6	13	2	94
March 7	0	239	542	16	2,680	5.6	10	0	72
March 9	0	210	644	92	2,850	5.5	7	2	54
March 10	0	217	600	48	2,880	5.6	10	1	78
March 14	0	295	387	184	1,760	5.4	4	2	19
March 15	0	236	542	80	2,740	5.4	1	0	7
March 15	0	308	300	48	1,480	5.4	1	0	4
March 16	0	263	561	36	2,580	5.4	4	0	28
March 17	0	281	512	56	2,530	5.5	7	1	48
March 20	0	281	338	112	1,850	5.4	2	1	10
March 21	0	232	522	116	2,640	5.6	12	4	85
March 22	0	217	580	152	2,750	5.6	8	3	59
March 23	0	204	600	12	3,060	5.6	14	0	116
March 24	0	204	608	156	2,940	5.8	28	12	222
March 25	0	204	570	204	2,820	6.0	46	25	350
March 26	0	217	396	240	2,200	6.0	46	30	273
March 27	0	191	406	168	2,040	6.0	46	21	253
March 28	0	198	377	192	1,960	6.1	58	30	306
March 29	0	172	377	400	2,010	6.2	65	70	352
March 30	0	179	377	476	1,950	6.2	73	94	385
March 31	0	204	318	1,100	1,880	6.4	113	334	573
April 4	0	83	116	2,180	816	7.0	500	2,950	1,100
April 5	0	165	213	2,870	1,270	7.0	500	3,880	1,710
April 6	0	179	203	4,130	1,250	7.1	555	6,200	1,870
April 7	0	160	193	2,400	1,220	6.8	340	2,210	1,120
April 8	0	185	193	3,070	1,120	6.8	370	3,060	1,120
April 9	0	185	203	2,420	1,140	6.7	260	1,700	803
April 10	0	198	222	1,410	1,260	6.4	175	665	595
April 11	0	198	242	856	1,390	6.4	162	375	608
April 12	0	198	232	788	1,380	6.2	114	243	426
April 13	0	191	271	2,720	1,420	6.5	200	1,470	764
April 14	0	172	222	1,080	1,340	6.7	260	760	940
April 15	0	191	348	1,090	1,710	6.4	175	516	809
April 16	0	204	319	772	1,790	6.2	125	261	603
April 17	0	204	281	504	1,580	6.1	103	140	490
April 18	0	204	329	384	1,680	6.1	103	107	468
April 19	0	185	329	228	1,880	6.0	85	52	432
April 20	0	191	367	176	1,890	6.2	115	55	586
April 21	0	191	396	640	2,000	6.4	175	303	944
April 22	0	191	290	1,610	1,640	6.7	260	1,130	1,150
April 23	0	191	242	1,140	1,350	6.4	120	368	437
April 24	0	198	242	952	1,360	6.4	96	247	353
April 25	0	191	281	368	1,540	6.3	60	60	250
April 26	0	179	290	416	1,470	6.2	38	43	1,510
April 27	0	185	290	264	1,570	6.1	27	19	115
April 28	0	185	329	132	1,720	6.0	20	7	93
April 29	0	185	348	104	1,790	6.0	20	6	97
April 30	0	160	290	244	1,540	6.2	32	21	134
May 2	0	89	174	2,670	1,140	6.8	365	2,640	1,120
May 3	0	166	174	1,980	1,100	6.6	200	1,070	595
May 4	0	160	174	1,090	1,050	6.4	90	266	256

Partial analyses, gage heights, and rates of discharge of water and solids for North Fork of Red River at railroad bridge near Granite, Okla.—Continued.

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–1907.									
May 5	0	179	174	760	1,160	6.3	70	144	219
May 6	0	192	223	600	1,350	6.2	52	84	189
May 7	0	198	271	412	1,480	6.2	43	48	172
May 8	0	185	339	296	1,680	6.2	43	34	196
May 9	0	185	310	276	1,660	6.1	34	25	153
May 10	0	192	339	116	1,840	6.1	34	11	169
May 11	0	179	416	120	2,020	6.0	21	7	114
May 12	0	185	426	48	2,060	6.0	21	3	117
May 13	0	153	455	32	2,270	6.0	18	2	110
May 15	0	166	416	112	2,050	6.0	23	7	127
May 16	0	134	290	2,530	1,520	6.4	102	696	420
May 17	0	134	281	1,570	1,550	6.5	140	592	586
May 18	0	134	261	1,140	1,470	6.5	140	429	557
May 19	0	160	242	664	1,370	6.4	120	215	443
May 20	0	172	232	428	1,370	6.4	95	110	352
May 21	0	179	261	264	1,430	6.2	52	37	200
May 22	0	179	339	444	1,650	6.1	62	74	277
May 23	0	160	290	204	1,580	6.2	52	29	222
May 24	0	128	106	12,400	620	8.0	2,600	87,300	4,350
May 25	0	140	154	6,900	836	8.0	2,350	43,800	5,300
May 26	0	140	154	3,240	1,000	7.1	920	8,050	2,480
May 27	0	166	184	1,370	1,230	6.5	140	519	464
May 28	0	185	193	960	1,220	6.4	100	259	329
May 29	0	198	223	612	1,390	6.2	73	121	273
May 30	0	199	300	292	1,650	6.2	61	48	272
May 31	0	179	309	268	1,680	6.2	50	36	227
June 1	0	96	258	312	1,650	6.0	23	19	102
June 2	0	108	138	2,170	920	6.6	165	968	410
June 3	0	115	109	4,140	648	6.6	275	3,080	481
June 4	0	121	129	1,970	692	6.7	315	1,680	589
June 5	0	147	248	1,230	1,190	6.6	275	911	855
June 6	0	185	376	2,970	1,720	7.0	560	4,490	2,610
June 7	0	166	258	1,490	1,410	6.4	140	562	534
June 8	0	172	248	1,020	1,330	6.3	86	237	310
June 9	0	172	248	564	1,470	6.1	40	61	159
June 10	0	159	297	400	1,500	6.0	40	43	162
June 11	0	166	327	244	1,630	6.0	40	26	176
June 12	0	172	396	204	2,250	6.0	40	22	243
June 13	0	191	396	160	1,850	6.0	40	17	200
June 14	0	185	386	84	1,880	6.1	44	10	223
June 15	0	159	228	1,100	1,270	6.2	73	216	250
June 16	0	159	337	648	1,780	6.2	73	128	350
June 17	0	153	366	700	1,850	6.5	160	302	800
June 18	0	159	416	616	1,990	6.4	140	233	753
June 19	0	153	376	344	1,860	6.2	75	70	377
June 20	0	159	327	308	1,930	6.2	58	48	303
June 21	0	178	396	592	2,030	6.4	87	139	476
June 22	0	166	307	368	1,810	6.2	43	43	211
June 23	0	178	277	500	1,560	6.0	27	37	114
June 24	0	166	317	324	1,600	6.2	47	41	204
June 25	0	134	317	472	1,430	6.1	46	59	177
June 26	0	128	119	6,180	800	7.9	2,350	39,200	5,080
June 27	0	128	89	2,490	636	6.5	211	1,420	362
June 28	0	140	128	1,100	828	6.4	128	379	286
June 29	0	170	236	340	1,370	6.2	67	62	248
June 30	0	172	257	196	1,430	6.2	53	28	205
July 1	0	179	297	72	1,720	6.1	63	12	293
July 2	0	172	342	148	1,850	6.1	63	25	315
July 3	0	185	416	116	1,990	6.0	43	13	232
July 4	0	192	396	148	2,060	6.0	43	17	240
July 5	0	236	416	268	2,010	6.0	34	25	185
July 6	0	192	426	92	2,100	5.9	24	6	136
July 7	0	179	396	128	1,910	5.8	8	3	41
July 8	0	166	366	120	1,380	5.8	15	5	56
July 9	0	147	337	340	1,550	7.7	1,350	1,240	5,660
July 11	0	134	109	1,600	732	6.9	385	1,660	761
July 12	0	147	138	6,870	868	7.3	735	13,600	1,720
July 13	0	160	119	4,500	760	7.6	1,110	13,500	2,280

Partial analyses, gage heights, and rates of discharge of water and solids for North Fork of Red River at railroad bridge near Granite, Okla.—Continued.

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–1907.									
July 14	0	150	158	2,610	1,010	8.0	2,480	17,500	6,770
July 15	0	164	168	2,050	920	6.7	286	1,580	711
July 16	0	176	158	6,000	1,030	7.9	2,250	36,500	6,250
July 17	0	190	138	4,720	912	7.2	700	8,920	1,720
July 18	0	164	158	2,680	928	6.8	310	2,250	776
July 19	0	170	148	1,610	1,010	6.6	218	946	595
July 20	0	183	158	888	1,140	6.6	240	575	735
July 21	0	183	168	2,400	1,150	7.0	450	2,920	1,400
July 22	0	170	218	1,480	1,210	6.8	310	1,230	1,010
July 24	0	157	198	476	1,280	6.2	45	58	155
July 25	0	170	228	332	1,260	6.2	45	40	152
July 27	0	164	238	284	1,430	6.2	45	35	173
August 1	0	164	158	980	1,070	6.6	120	318	346
August 2	0	170	188	580	1,180	6.5	90	141	287
August 3	0	164	198	492	1,270	6.4	65	86	222
August 4	0	144	218	348	1,330	6.2	40	38	144
August 5	0	144	178	976	1,080	6.8	355	937	1,040
August 6	0	131	188	2,660	1,140	7.3	750	5,390	2,320
August 7	0	164	178	1,800	1,110	6.8	330	1,600	985
August 8	14	127	152	1,880	972	6.9	415	2,110	1,090
August 9	15	119	164	772	1,120	6.5	195	406	591
August 10	10	132	124	4,170	860	7.4	900	10,200	2,090
August 10	26	153	97	11,000	788	8.5	3,000	89,300	6,380
August 11	0	194	97	8,670	700	7.6	1,180	27,600	2,230
August 12	0	164	98	7,290	732	7.4	950	18,700	1,880
August 13	0	160	109	1,820	488	7.2	700	3,440	922
August 14	0	162	89	3,730	684	6.6	85	858	157
August 15	0	178	124	1,110	876	6.3	132	397	312
August 17	13	137	170	712	1,060	6.2	95	183	272
August 18	6	162	173	700	1,100	6.2	120	227	355
August 20	0	245	123	172	924	6.0	50	23	125
August 21	0	234	100	1,520	852	6.0	50	205	115
August 22	13	144	253	180	1,550	6.0	50	24	210
August 24	13	137	296	248	1,700	6.0	50	33	229
August 27	12	153	304	124	1,800	6.8	285	95	1,390
August 29	4	142	132	1,880	940	6.4	172	874	437
August 30	13	123	163	1,040	1,190	6.5	185	522	594
August 31	12	136	170	956	884	6.4	159	411	380
September 3	11	153	142	460	1,050	6.3	90	112	256
September 4	0	188	221	5,540	1,340	7.6	1,180	17,600	4,270
September 5	18	99	113	2,350	804	7.0	550	3,500	1,190
September 6	0	149	126	1,380	1,020	6.9	420	1,570	1,150
September 7	0	164	151	668	1,040	6.8	350	632	986
September 8	17	133	132	1,040	876	6.6	240	676	568
September 8	0	190	328	144	1,880	6.6	240	93	1,220
September 9	0	163	211	396	1,300	6.6	250	267	874
September 10	0	154	208	348	1,320	6.6	180	168	639
September 10	0	212	239	284	1,480	6.4	145	111	581
September 12	0	394	20	3,550	468	6.4	125	1,200	158
September 13	0	195	420	164	1,810	6.4	125	55	612
September 14	0	190	418	868	1,740	6.4	145	340	682
September 15	0	141	327	344	1,400	6.6	180	167	680
September 16	0	162	209	1,010	1,380	8.5	3,000	8,160	11,200
September 17	0	117	84	1,260	536	7.9	1,600	5,450	2,320
September 18	0	137	156	1,220	960	8.0	1,700	5,600	4,410
September 19	32	63	147	3,320	964	7.9	1,600	14,400	4,160
September 20	16	140	147	1,600	960	7.0	460	1,990	1,190
September 21	19	131	146	1,690	956	6.8	400	1,830	1,030
September 22	0	136	95	1,520	588	6.7	300	1,230	477
September 23	19	75	89	1,300	604	7.0	580	2,030	945
September 24	0	191	324	152	1,810	6.6	250	103	1,220
September 25	11	182	222	296	1,750	6.6	250	200	1,180
September 26	0	188	328	100	1,850	6.4	150	40	748
September 27	8	120	326	92	1,844	6.4	130	32	648
September 28	16	119	313	100	1,830	6.4	125	34	617
September 29	26	116	341	92	1,880	6.4	90	22	457
September 30	23	124	328	112	1,940	6.4	60	18	315
October 1	0	363	60	88	548	6.4	60	14	89

Partial analyses, gage heights, and rates of discharge of water and solids for North Fork of Red River at railroad bridge near Granite, Okla.—Continued.

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–1907.									
October 3	0	196	371	44	1,800	6.3	33	4	161
October 4	0	216	139	36	888	6.2	15	1	36
October 4	0	228	343	156	1,530	6.8	300	126	1,240
October 7	0	273	348	0	1,360	6.3	33	0	121
October 8	0	185	513	0	2,120	6.3	33	0	188
October 9	0	280	246	56	1,240	6.3	33	5	111
October 10	0	201	436	128	2,090	6.4	60	21	339
October 11	0	270	347	576	1,180	6.4	45	70	143
October 12	0	335	86	64	716	6.2	23	4	44
October 13	0	298	150	0	1,010	6.2	23	0	63
October 14	0	125	109	960	680	7.2	900	2,330	1,650
October 15	0	148	152	16,000	884	9.9	7,000	302,000	16,700
October 16	0	159	140	7,420	924	7.8	1,950	39,100	4,860
October 17	0	184	152	3,650	876	7.2	1,180	11,600	2,790
October 18	0	199	168	2,340	996	6.8	875	5,520	2,350
October 19	0	252	191	2,370	712	6.6	775	4,960	1,490
October 20	0	218	210	1,550	1,150	6.5	650	2,720	2,010
October 21	0	232	217	1,130	1,190	6.4	220	673	709
October 22	0	212	221	1,230	1,190	6.4	220	730	706
October 23	0	222	264	2,680	1,290	6.8	355	2,570	1,230
October 24	0	211	224	1,630	1,150	6.6	272	1,200	843
October 25	0	224	226	1,470	1,250	6.6	254	1,010	860
October 26	0	236	228	968	1,280	6.4	300	784	1,030
October 27	0	208	232	796	1,360	6.4	400	860	1,470
October 29	0	172	266	732	1,490	6.3	420	830	1,690
October 30	0	217	285	516	1,530	6.3	415	578	1,710
October 31	0	226	286	492	1,550	6.2	385	511	1,610
November 1	0	218	285	496	1,540	6.2	113	151	409
November 2	0	225	298	424	1,580	6.2	113	129	480
November 3	0	176	306	536	1,550	6.2	113	164	472
November 4	0	213	307	872	1,550	6.4	190	448	797
November 5	0	209	307	76	2,030	6.4	207	42	1,140
November 7	0	190	314	644	1,560	6.5	245	426	1,030
November 8	0	166	306	564	1,500	6.4	226	345	920
November 9	0	204	297	1,430	1,540	6.7	327	1,260	1,360
November 11	0	196	217	624	1,300	6.6	267	450	940
November 13	0	176	277	374	1,520	6.4	227	229	935
November 14	0	210	282	432	1,530	6.5	247	288	1,020
November 15	0	210	289	300	1,570	6.5	247	200	1,040
November 16	0	206	303	428	1,580	6.5	247	286	1,060
November 25	0	226	288	824	1,440	6.9	440	980	1,710
November 26	0	168	160	2,210	1,010	7.4	1,250	7,470	3,400
November 27	0	230	210	2,840	1,280	7.6	1,420	10,900	4,890
November 29	0	221	202	2,040	1,180	7.2	1,180	6,500	3,750
November 30	0	234	234	1,920	1,200	7.4	1,250	6,490	4,070
December 1	0	231	208	3,030	1,170	7.5	1,360	11,100	4,310
December 2	0	228	188	3,830	1,040	7.8	2,250	23,300	6,350
December 3	0	220	156	4,030	968	7.8	2,250	24,500	5,890
December 3	0	266	257	860	1,400	7.0	400	930	1,510
December 4	0	220	149	2,740	892	7.5	1,150	8,500	2,770
December 5	0	261	149	512	880	7.4	900	1,240	2,140
December 6	0	261	190	2,720	1,150	7.2	725	5,310	2,240
December 7	0	268	196	1,250	1,180	7.0	400	1,350	1,280
December 8	0	307	195	628	1,090	6.8	225	382	661
December 12	0	331	188	268	1,160	7.0	450	325	1,400
December 12	0	388	100	76	792	6.8	225	46	481
December 15	0	255	262	964	1,410	7.2	425	1,100	1,610
December 17	0	284	238	648	1,300	6.9	170	298	595
December 18	0	281	257	480	1,410	6.8	100	130	381
December 19	0	286	268	452	1,560	7.2	450	550	1,900
December 20	9	267	279	556	1,380	7.2	385	578	1,430
December 21	0	286	279	860	1,560	7.0	300	697	1,260
December 23	0	267	279	948	1,450	7.0	140	359	550
December 26	9	238	279	852	1,550	7.0	75	172	313
December 28	0	248	279	660	1,540	7.0	125	223	520
December 29	0	238	279	604	1,550	7.0	125	204	522
December 30	0	229	289	1,080	1,460	7.1	175	510	690
December 31	0	238	289	700	1,440	7.0	125	233	478

Partial analyses, gage heights, and rates of discharge of water and solids for North Fork of Red River at railroad bridge near Granite, Okla.—Continued.

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–1907.									
January 1	0	238	258	776	1,540	7.0	140	294	582
January 2	0	224	242	549	1,540	7.1	180	267	750
January 3	0	248	268	560	1,520	7.1	180	272	739
January 5	0	248	310	728	1,590	7.0	140	275	602
January 6	0	248	279	1,330	1,540	6.8	70	252	291
January 7	0	238	289	520	1,520	6.9	100	141	411
January 8	9	229	289	132	1,680	6.9	100	36	455
January 9	0	286	320	3,480	1,640	7.9	660	6,210	2,920
January 10	0	191	217	3,940	1,140	8.1	800	8,520	2,460
January 12	0	238	217	2,690	1,090	7.4	340	2,470	1,000
January 13	19	238	227	264	2,620	7.2	220	157	1,560
January 14	19	248	227	1,220	1,480	7.0	160	528	637
January 15	9	267	227	999	1,500	7.0	160	430	645
January 16	9	277	196	1,320	1,370	7.5	400	1,430	1,480
January 17	9	267	237	876	1,460	7.0	160	378	632
January 18	9	267	310	988	1,530	7.0	160	426	661
January 19	9	191	206	4,500	1,370	8.6	1,500	18,300	5,560
January 20	.....	.....	165	5,920	1,670	8.5	1,400	22,400	6,300
January 21	9	210	155	3,980	1,080	7.4	350	3,720	1,010
January 22	19	238	186	1,630	1,260	7.0	200	879	683
January 23	9	286	217	964	1,310	7.0	160	416	567
January 24	19	267	217	1,230	1,400	7.0	180	600	680
January 25	9	267	227	1,080	1,480	7.0	160	467	640
January 26	9	305	248	848	1,550	7.0	180	413	752
January 27	14	277	258	900	1,540	7.0	180	437	748
January 28	9	296	279	428	1,580	6.8	120	139	512
January 29	14	267	268	600	1,640	7.0	160	259	709
January 30	9	248	289	788	1,670	7.0	180	383	813
February 1	9	191	227	1,330	1,340	7.2	270	971	976
February 2	19	172	258	1,060	1,520	7.1	250	715	1,030
February 3	0	200	268	1,400	1,510	7.0	200	753	814
February 5	0	229	289	204	1,540	6.4	10	6	42
February 6	0	210	330	288	1,520	6.7	90	70	369
February 7	0	191	268	568	1,620	7.3	340	523	1,490
February 8	0	191	320	992	1,628	7.2	300	803	1,320
February 9	0	210	289	2,320	1,530	7.5	450	2,820	1,860
February 11	9	229	268	680	1,420	7.0	180	331	688
February 12	0	196	258	592	1,450	6.9	160	256	625
February 13	9	172	279	604	1,550	7.0	180	294	751
February 14	0	191	289	728	1,580	6.8	120	236	512
February 15	0	181	289	1,200	1,550	7.1	250	806	1,050
February 16	9	238	289	660	1,580	6.9	160	285	683
February 17	0	191	294	520	1,600	7.0	160	225	691
February 18	19	200	310	464	1,600	7.0	160	201	693
February 19	9	172	320	380	1,760	7.0	160	164	760
February 20	9	162	310	264	1,680	7.1	200	143	907
February 21	9	172	310	468	1,720	7.0	140	177	650
February 22	9	181	315	328	1,690	7.0	180	159	821
February 23	9	152	310	280	1,740	7.0	120	91	564
February 24	9	172	310	296	1,750	7.0	140	112	660
February 25	9	162	340	388	1,780	7.1	160	125	769
February 26	9	162	310	256	1,740	7.0	120	83	565
February 27	9	191	310	182	1,740	7.2	200	98	940
February 28	9	172	310	292	1,730	7.1	160	126	746
March 1	9	172	330	520	1,840	7.3	190	267	944
March 3	9	181	330	460	1,900	7.3	190	236	975
March 5	9	229	279	40	1,620	7.2	150	16	656
March 6	9	219	289	280	1,610	7.1	70	58	304
March 7	19	210	310	228	1,720	7.1	70	43	325
March 9	9	205	310	212	1,720	7.1	70	40	325
March 10	0	220	281	84	1,790	7.1	70	16	338
March 11	0	238	320	160	1,690	7.2	100	43	457
March 12	0	229	320	200	1,750	7.2	90	49	425
March 13	0	205	329	160	1,710	7.1	70	30	324
March 14	5	214	306	188	1,660	7.1	70	36	315
March 15	5	215	315	184	1,640	7.1	70	35	311
March 16	9	234	302	156	1,740	7.1	80	34	376

Relative amount of substances in solution in water from North Fork of Red River at railroad bridge near Granite, Okla.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905–1907.											
April 13–June 17	25	+4.3	1,310	15	3.4	14	0.76	12	36	19	0.007
June 18–July 30	21	+4.4	1,970	13	3.7	[a] 15	.00	9.4	36	21	.005
July 21–November 1	28	.....	1,120	.....	3.8	12	.00	19	36	18	.000
October 31–December 1	19	.....	1,280	14	3.8	.....	.00	15	37	19	.003
December 3–January 6	19	−1.0	1,600	12	3.2	15	.00	12	34	22	.003
January 8–25	16	−3.0	1,870	11	3.3	15	.00	10	36	23	.002
February 1–March 31	48	.....	2,100	14	3.8	.....	.76	9.5	36	21	.002
April 4–30	26	+0.6	1,480	12	4.1	15	.00	13	38	19	.000
May 2–31	29	.....	1,490	.....	.....	13	.42	11	36	19	.000
June 1–30	30	−1.2	1,470	12	3.7	12	.00	12	33	20	.000
July 1–27	24	+4.3	1,340	13	4.0	15	.00	13	37	19	.000
August 1–31	26	+4.5	1,050	14	4.2	14	.00	17	36	17	.004
September 3–30	29	+3.1	1,300	11	3.8	16	.00	12	36	18	.000
October 1–31	38	+1.5	1,350	12	3.9	14	.00	17	33	18	.033
November 1–30	18	.....	1,450	12	3.9	.....	.00	14	.....	19	.015
December 1–31	24	+ .5	1,350	12	3.5	14	.00	18	34	17	.066
January 1–30	28	+2.1	1,400	11	4.5	15	.00	17	35	18	.031
February 1–28	26	+2.2	1,690	9.5	4.7	15	.00	7.8	37	20	.....
March 1–16	13	.....	1,680	11	5.1	.....	.00	11	40	19	.000
Mean	.....	2.5	1,490	12	3.9	14	.10	13	36	19	.010

[a] Sodium is 99.6 per cent and potassium is 0.53 per cent of this amount.

Monthly discharge, in second-feet, of North Fork of Red River near Granite, Okla.

Month.	1903.	1904.	1905.	1906.	1907.	1908.	Mean.
January	.....	0	.....	56	313	128	124
February	.....	0	.....	46	187	131	91
March	.....	0	.....	22	72	[a] 121	54
April	.....	0	.....	173	116	.....	96
May	.....	312	.....	262	204	.....	259
June	[a] 23	651	.....	191	848	.....	428
July	20	221	.....	492	102	.....	209
August	[a] 53	81	.....	297	417	.....	212
September	3	0	.....	497	62	.....	141
October	1	0	.....	562	733	.....	324
November	0	0	.....	414	295	.....	177
December	0	0	.....	468	177	.....	161
Mean	.....	105	.....	290	294	.....	190

[a] Approximate.

NORTH FORK OF RED RIVER NEAR HEADRICK, OKLA.

Samples of water were collected from North Fork of Red River at Navajo dam site near Headrick, Okla., from May 20, 1905, to March 19, 1907. A gaging station was established at the Frisco Railway bridge, 8 miles west of Snyder, by the United States Geological Survey, April 14, 1905, and was discontinued July 31, 1905; and a gaging station was established at Navajo dam site July 17, 1905, and discontinued March 30, 1908. Stream-flow data, including gage heights

and estimates of discharge, have been published by the Survey in the following reports:[a]

Water-Supply Papers: 173, pp. 75–78; 209, pp. 54–56; 247, pp. 93–96.

Partial analyses, gage heights, and rates of discharge of water and solids for North Fork of Red River at Navajo dam site, near Headrick, Okla.

[Drainage area, 5,470 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–1907.									
May 20, 21, 22, 25, 26, 27	2	151	426	3,630	1,310	3.2	2,300	22,600	8,100
May 28, 29, June 3, 4, 5, 6, 8, 10	12	140	558	3,590	2,100	3.8	2,900	28,100	16,400
May 29	.....	.....	.....	8,880	720	5.0	8,000	192,000	15,600
May 30	.....	.....	.....	5,070	858	4.2	3,000	41,100	6,950
June 11, 12, 14, 15, 16, 17	0	175	981	510	3,150	2.4	500	689	4,260
June 18, 19, 20, 21, 22, 23, 24	0	161	1,900	854	5,310	2.2	450	1,040	6,450
June 25, 26, 27, 28, 29, 30, July 1	0	149	1,190	584	3,960	1.9	250	394	2,680
July 2, 3, 4, 5, 6, 7, 8	0	152	1,830	388	4,970	1.7	140	147	1,880
July 9, 10, 11, 12, 13, 14, 15	0	161	1,990	430	5,340	1.6	120	139	1,730
July 16, 17, 18, 19, 20, 21, 22	0	174	2,660	352	6,410	1.6	120	114	2,080
July 23, 24, 25, 26, 27, 28, 29	5	114	1,220	1,000	3,230	1.9	250	677	2,180
July 25, 26, 27, 28, 29, 30, 31	0	130	1,700	578	4,490	2.5	244	381	2,960
August 1, 2, 5, 6, 7	9	338	1,870	290	5,270	2.5	266	208	3,780
August 14, 15, 24, 25, 26, 28	0	141	1,120	2,680	3,330	3.0	1,210	8,770	10,900
September 1, 3, 4, 5	6	160	2,270	250	5,610	2.0	41	28	621
September 13	.....	.....	.....	924	1,740	3.1	370	923	1,740
September 16, 17, 18, 20, 21, 23, 24	0	165	1,300	368	3,730	2.6	149	148	1,500
September 25, 26, 27, 28, 29, 30, October 1	6	155	2,160	114	5,580	2.2	54	17	814
October 2, 3, 6, 7, 8, 10, 11	4	167	2,610	302	6,490	2.2	36	29	630
October 14, 15, 16, 17, 18, 19, 20	11	146	2,850	212	6,940	2.1	24	14	450
October 24, 25, 26, 28	8	185	3,100	256	7,380	2.1	24	17	479
October 29, November 13, 14, 15, 16, 17, 18	0	185	1,660	408	4,350	2.3	238	262	2,800
November 19, 20, 21, 22, 23, 24, 25	0	188	1,430	1,730	3,830	2.7	290	1,360	3,000
November 26, 28, 30, December 1, 2	0	172	641	2,170	2,170	2.5	169	989	989
December 3, 4, 5	0	218	1,100	578	3,050	2.6	160	250	1,320
December 6	0	218	1,250	660	3,600	2.6	140	250	1,360
December 7	0	205	1,260	692	3,640	2.6	130	243	1,280
December 8	0	238	1,360	292	3,940	2.6	120	95	1,270
December 9	0	238	1,380	488	4,150	2.6	120	158	1,350
December 10	0	238	1,400	452	3,960	2.6	120	146	1,280
December 11	0	231	1,590	256	4,320	2.5	100	69	1,170
December 12	0	231	1,530	564	4,100	2.5	100	153	1,110
December 13	0	185	1,770	436	4,430	2.7	170	200	2,040
December 14	0	224	1,520	228	4,040	2.7	170	105	1,860
December 15	0	185	2,820	1,140	6,620	2.7	170	524	3,040
December 16	0	193	810	1,380	2,620	3.0	320	1,190	2,270
December 17	27	156	984	1,030	2,960	2.7	230	640	1,830
December 18	13	195	1,470	492	4,060	2.7	230	305	2,520
December 31	0	238	1,550	288	4,120	2.6	170	132	1,890
January 2	0	226	1,520	396	4,020	2.6	160	171	1,730
January 3	0	224	1,550	6,390	4,020	2.6	160	2,760	1,730
January 4	0	238	1,550	404	4,110	2.6	160	174	1,770
January 5	0	231	1,730	636	4,400	2.6	160	275	1,900
January 6	13	191	1,730	452	4,440	2.8	235	286	2,820
January 7	0	231	1,420	496	3,880	2.7	195	261	2,040
January 8, 9, 10, 11, 12, 13, 14	0	224	1,560	286	4,140	2.6	166	128	1,860
January 15	0	231	1,430	372	3,820	2.5	130	131	1,340
January 16	0	224	1,420	364	3,890	2.6	160	157	1,680
January 17	0	216	1,480	384	3,960	2.5	130	135	1,390
January 18	0	227	1,610	224	4,200	2.5	130	79	1,470
January 19	0	218	1,630	212	4,300	2.5	130	74	1,510
January 20	0	205	1,670	264	4,290	2.5	130	93	1,510
January 21	0	211	1,790	216	4,710	2.5	125	73	1,590
January 23	0	244	1,860	280	4,870	2.5	120	91	1,580

[a] See also Fifth Ann. Rept. U. S. Reclamation Service, p. 245.

Partial analyses, gage heights, and rates of discharge of water and solids for North Fork of Red River at Navajo dam site, near Headrick, Okla.—Continued.

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–1907.									
February 4	------	277	2,670	56	6,520	2.4	94	14	1,650
February 5	0	249	2,240	108	5,570	2.4	95	28	1,430
February 6	0	277	1,840	108	4,940	2.3	70	20	935
February 7	0	280	1,840	616	4,940	2.3	70	116	935
February 8	0	252	2,230	64	5,570	2.3	70	12	1,050
February 9	0	233	2,680	172	6,400	2.2	47	22	812
February 11	0	221	2,110	136	5,370	2.2	47	17	683
February 12	0	230	2,130	256	5,350	2.2	47	32	677
February 13	0	235	2,110	72	5,430	2.2	47	9	688
February 14	0	195	1,490	1,590	3,580	2.2	47	201	453
February 15	0	209	1,490	940	4,230	2.2	47	119	537
February 17	0	237	1,630	388	4,220	2.7	198	207	2,260
February 25	0	210	1,890	368	4,420	2.3	70	70	835
February 27	0	217	1,890	268	4,770	2.2	47	34	605
February 28	0	231	2,000	484	4,870	2.2	47	61	619
March 2	0	243	2,100	1,120	5,580	2.2	47	142	709
March 3	0	249	2,220	1,670	5,870	2.1	40	181	635
March 4	0	249	2,210	0	5,880	2.1	40	0	635
March 5	0	243	2,280	116	5,860	2.1	40	13	634
March 6	0	230	2,290	848	5,930	2.1	40	92	641
March 7	0	236	2,470	148	6,200	2.1	38	15	636
March 8	0	223	2,380	124	6,080	2.1	36	12	590
March 9	0	225	2,500	68	6,180	2.1	36	7	600
March 10	0	223	2,550	0	6,270	2.1	36	0	608
March 20	0	236	3,160	236	7,620	2.0	34	22	700
March 21	0	243	3,160	28	7,550	2.1	35	3	713
March 22	0	236	3,130	0	7,470	2.1	36	0	726
March 23	0	230	3,270	72	7,990	2.1	37	7	798
March 24	0	223	2,970	0	7,290	2.1	38	0	747
March 25	0	230	2,980	8	7,250	2.1	38	1	744
March 26	0	197	2,540	208	6,340	2.1	38	21	650
March 27	0	217	1,770	364	4,770	2.3	70	69	900
April 1	0	179	1,320	512	4,070	2.5	110	152	1,210
April 2	0	191	1,340	492	4,080	2.4	90	120	990
April 3	0	185	1,590	288	4,400	2.3	70	54	831
April 17	0	192	948	400	3,190	2.8	230	248	1,980
April 18	0	198	908	356	3,050	2.7	210	202	1,730
April 19	0	192	928	1,410	3,090	2.7	210	798	1,750
April 20	0	220	1,000	656	3,180	2.7	210	372	1,810
April 22	0	220	996	908	3,090	3.0	305	748	2,550
April 24	0	227	986	2,140	3,090	2.7	160	925	1,340
April 25	0	227	1,120	820	3,240	2.6	130	288	1,140
April 26	0	220	1,130	700	3,220	2.6	130	246	1,130
April 27	0	220	1,400	520	3,890	2.5	115	162	1,210
April 28	0	217	1,260	324	3,520	2.5	115	101	1,090
April 29	0	192	1,330	464	3,640	2.6	130	163	1,270
April 30	0	102	261	2,470	772	4.3	1,480	9,860	3,080
May 1	0	121	329	820	960	3.6	600	1,330	1,560
May 2	0	154	1,340	9,750	4,070	4.6	1,680	44,200	18,500
May 3	0	154	387	2,230	1,880	3.6	600	3,620	3,040
May 4	0	172	387	816	1,740	3.6	600	1,320	2,830
May 5	0	172	522	360	2,040	3.5	520	506	2,870
May 7	0	198	957	284	3,060	2.9	170	131	1,410
May 10	0	198	1,260	712	3,730	2.7	90	173	908
May 11	0	198	1,280	220	3,730	2.7	90	53	908
May 12	0	185	1,570	348	4,320	2.7	90	85	1,050
May 15	0	153	416	11,700	1,310	5.6	6,450	205,000	22,900
May 16	0	102	435	10,300	2,550	4.2	1,350	37,600	9,300
May 17	0	115	368	4,240	2,190	3.7	680	7,780	4,020
May 18	0	128	426	876	2,260	3.6	600	1,420	3,660
May 21	0	165	774	404	2,850	3.1	280	305	2,150
May 22	0	179	1,090	380	3,640	3.2	320	329	3,150
May 23	0	122	851	9,390	2,840	3.2	320	8,120	2,480
May 24	0	128	841	8,620	2,800	4.3	1,320	30,700	9,950
May 25	0	108	300	8,710	1,870	5.1	4,080	96,000	20,600
May 26	0	115	203	5,390	1,660	4.2	1,250	18,200	5,600
May 27	0	122	203	2,580	1,540	3.9	875	6,100	3,640
May 28	0	160	329	1,010	1,940	3.4	380	1,030	1,990

Partial analyses, gage heights, and rates of discharge of water and solids for North Fork of Red River at Navajo dam site, near Headrick, Okla.—Continued.

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–1907.									
May 29	0	153	561	616	2,490	3.1	260	433	1,750
May 30	0	147	735	332	2,820	3.0	220	198	1,680
May 31	0	128	909	312	3,270	3.0	220	186	1,940
June 1	0	147	1,070	220	3,600	3.0	170	101	1,650
June 2	0	166	1,090	416	3,330	3.2	260	292	2,340
June 3	0	134	603	6,340	2,320	4.6	2,040	35,000	12,800
June 4	0	110	465	6,100	2,030	4.0	1,000	16,500	5,480
June 5	0	121	475	6,170	1,970	4.4	1,680	28,000	8,950
June 6	0	121	297	3,340	1,760	4.0	1,000	9,000	4,750
June 7	0	140	357	1,620	1,900	3.5	465	2,030	2,390
June 8	0	146	475	808	2,230	3.2	260	568	1,570
June 9	0	166	1,090	332	3,480	3.0	170	153	1,600
June 10	0	153	1,090	248	3,520	3.0	170	114	1,620
June 11	0	147	1,090	308	3,500	3.0	170	142	1,610
June 12	0	172	1,420	116	4,250	2.9	170	53	1,950
June 13	0	166	1,420	80	4,340	2.8	160	35	1,880
June 14	0	147	1,140	476	3,480	2.8	160	206	1,500
June 15	0	140	1,210	488	3,480	3.1	480	634	4,520
June 16	0	128	1,030	8,850	4,110	3.1	480	11,500	5,340
June 18	0	140	515	812	2,700	3.5	520	1,140	3,790
June 19	0	148	515	836	2,660	3.3	335	756	2,400
June 20	0	148	1,130	976	4,000	3.0	235	620	2,530
June 21	0	148	911	496	3,330	3.0	235	315	2,110
June 22	0	148	891	480	3,310	2.8	160	208	1,430
June 23	0	140	970	248	3,590	2.8	160	107	1,550
June 24	0	121	1,060	9,050	3,830	2.7	140	3,420	1,450
June 25	0	128	703	3,070	2,200	3.5	520	4,310	3,080
June 27	0	121	921	7,730	2,930	5.0	3,620	75,600	28,600
June 28	0	140	367	700	1,710	3.7	685	1,300	3,170
June 29	0	140	367	688	1,680	3.2	330	613	1,500
June 30	0	586	99	172	784	3.1	280	130	593
July 1	0	183	990	200	3,200	3.1	220	119	1,900
July 2	0	183	981	156	3,220	2.8	120	51	1,040
July 3	0	222	1,340	20	4,040	2.7	95	5	1,040
July 4	0	216	1,350	88	4,020	2.6	80	19	868
July 5	0	197	1,580	68	4,540	2.5	70	13	859
July 6	0	177	1,590	76	4,500	2.5	70	14	850
July 7	0	190	1,840	64	4,970	2.5	70	12	936
July 9	0	124	327	2,840	1,130	2.5	70	536	213
July 10	0	118	317	2,240	1,090	5.0	3,620	22,000	10,600
July 11	0	131	317	2,950	1,090	4.5	1,910	15,200	5,640
July 12	0	118	346	.....	.....	4.8	2,000	.....	.....
July 13	0	138	593	.....	.....	4.8	200	.....	.....
July 15	0	137	337	1,510	1,730	3.5	410	1,670	1,920
July 16	0	164	386	908	1,780	3.5	410	1,000	1,970
July 17	0	170	307	2,820	1,620	4.0	715	5,450	3,130
July 18	0	150	308	2,700	1,640	3.6	470	3,430	2,090
July 19	0	150	416	3,000	1,930	3.4	480	3,890	2,500
July 20	0	183	485	728	2,010	3.3	315	619	1,700
July 21	0	131	366	6,140	1,580	4.8	2,000	33,200	8,510
July 22	0	138	356	1,010	1,930	3.5	390	1,060	2,030
July 23	0	131	356	1,010	1,960	3.2	240	654	1,270
July 24	0	157	248	608	2,110	3.1	200	329	1,140
July 25	0	170	594	492	2,360	3.0	160	213	1,020
July 26	0	157	564	400	2,420	2.9	130	140	849
July 27	0	203	693	436	2,500	3.0	160	188	1,080
July 28	0	118	1,220	15,400	3,880	3.0	160	6,650	1,670
July 29	0	124	1,230	15,900	3,910	4.6	1,600	68,800	16,900
July 30	0	111	277	2,450	1,670	4.4	1,240	8,200	5,600
July 31	0	131	267	2,110	1,770	3.6	450	2,570	2,160
August 1	0	170	476	952	1,800	3.6	510	1,310	2,480
August 2	0	178	476	632	2,110	3.0	190	324	1,080
August 3	0	175	614	972	2,170	3.0	190	499	1,110
August 4	0	173	624	952	2,220	3.0	190	488	1,140
August 5	0	194	872	312	2,980	3.0	190	160	1,530
August 6	0	190	772	584	2,900	3.0	190	300	1,490
August 8	0	235	297	6,330	1,870	4.8	1,850	31,600	9,320
August 9	0	191	190	7,300	1,320	3.5	440	8,670	1,570

Partial analyses, gage heights, and rates of discharge of water and solids for North Fork of Red River at Navajo dam site, near Headrick, Okla.—Continued.

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–1907.									
August 10	0	144	406	10,200	2,800	5.3	2,680	73,700	20,300
August 12	0	152	198	5,220	1,350	5.3	2,680	37,800	9,750
August 13	0	131	222	2,020	1,550	3.9	740	4,030	3,090
August 14	0	122	192	2,090	1,440	3.4	380	2,140	1,480
August 16	0	144	391	704	1,990	3.0	280	532	1,510
August 17	0	131	814	1,780	3,180	2.9	245	1,180	2,100
August 18	0	151	816	292	3,220	2.8	224	177	1,940
August 19	0	172	960	468	3,270	2.7	180	227	1,590
August 20	0	161	1,140	448	3,700	2.7	180	218	1,800
August 20	13	176	302	884	1,730	2.7	180	430	839
August 21	19	118	1,110	1,080	2,940	2.6	130	378	1,030
August 22	0	144	1,220	500	3,700	2.4	95	128	950
August 24	0	120	893	72	3,300	2.0	20	4	178
August 24	31	86	1,410	168	4,440	2.0	20	9	240
August 25	6	98	768	720	2,560	2.0	20	39	138
August 26	13	104	973	8,470	3,160	2.0	20	458	171
August 27	0	115	550	6,060	2,640	4.9	2,000	32,800	14,300
August 27	0	98	218	4,280	1,660	4.9	2,000	23,100	8,970
August 28	0	171	1,400	696	4,020	3.8	700	1,320	7,600
August 29	0	124	228	1,620	1,530	3.4	380	1,660	1,570
August 30	0	110	294	820	1,800	3.2	280	620	1,300
August 31	0	132	375	636	1,930	3.0	220	378	1,150
September 1	13	124	515	532	2,220	3.0	220	316	1,320
September 2	2	148	672	376	2,640	2.9	190	193	1,350
September 4	12	137	732	424	2,752	3.2	295	338	2,190
September 5	6	108	196	1,380	1,320	4.9	2,700	1,010	965
September 6	26	107	422	6,040	2,100	3.8	755	12,300	4,270
September 8	4	135	795	600	2,840	2.3	70	113	537
September 9	0	150	649	228	2,610	2.5	80	49	565
September 10	0	152	653	132	2,700	2.7	120	43	875
September 11	0	171	794	388	3,040	2.7	120	126	987
September 12	0	162	882	152	3,350	2.7	120	49	1,080
September 13	0	150	888	84	3,380	2.6	95	22	866
September 15	0	220	511	388	2,260	3.4	380	398	2,320
September 24	0	178	399	1,300	1,840	4.0	980	3,460	4,860
September 25	0	183	378	292	1,840	3.4	395	311	1,960
September 26	0	182	373	152	1,810	3.3	340	140	1,660
September 27	0	216	903	136	3,380	3.4	395	145	3,600
September 28	0	222	907	136	3,360	3.2	295	108	2,670
September 29	0	209	912	268	3,280	2.9	185	134	1,640
September 30	0	241	1,250	172	3,800	2.8	135	63	1,390
October 10	0	212	1,830	280	4,990	2.7	90	68	1,210
October 11	0	186	1,610	156	4,380	2.6	80	34	945
October 13	0	153	740	824	2,210	2.6	65	145	389
October 15	0	143	184	7,540	1,230	5.6	5,980	122,000	19,900
October 18	0	167	256	2,200	1,320	3.9	1,220	7,230	4,330
October 19	0	194	341	1,480	1,620	3.6	680	2,710	2,970
October 20	0	196	473	1,170	2,040	3.6	680	2,150	3,750
October 22	0	201	646	916	2,430	3.4	520	1,290	3,420
October 23	0	226	676	1,030	2,340	3.4	460	1,280	2,900
October 24	0	237	619	1,390	2,300	3.6	820	3,080	5,100
October 26	0	209	693	824	2,510	3.4	480	1,070	3,260
October 27	0	229	760	728	2,740	3.3	390	768	2,880
October 28	0	234	834	612	2,970	3.2	335	553	2,690
October 29	0	222	941	392	3,160	3.2	310	328	2,650
October 30	0	220	887	580	3,110	3.2	265	415	2,230
October 31	0	240	942	528	3,140	3.2	250	357	2,130
November 2	0	230	1,070	92	3,420	3.2	250	62	2,310
November 2	0	216	1,250	468	3,660	3.4	400	505	3,960
November 5	0	211	1,080	336	3,460	3.2	290	263	2,710
November 6	0	195	1,100	360	3,360	3.2	270	263	2,460
November 7	0	182	1,010	20	3,200	3.2	300	16	2,590
November 8	0	216	1,030	532	3,330	3.4	390	560	3,510
November 9	0	172	1,180	1,410	3,840	3.6	560	2,140	5,800
November 10	23	105	564	1,410	2,420	3.4	435	1,650	2,840
November 13	5	206	988	324	3,290	3.2	290	254	2,580
November 14	0	186	1,090	184	3,480	3.2	290	144	2,730
November 15	10	183	1,150	292	3,470	3.2	255	201	2,390
November 16	0	208	1,140	180	3,640	3.2	270	131	2,660
November 21	19	196	944	4	3,200	3.1	110	1	962

Partial analyses, gage heights, and rates of discharge of water and solids for North Fork of Red River at Navajo dam site, near Headrick, Okla.—Continued.

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–1907.									
November 25	0	220	1,370	276	3,900	3.5	560	418	5,890
November 26	0	222	846	1,630	2,860	4.9	2,700	11,900	20,900
November 28	0	218	394	1,780	1,870	4.4	1,430	6,870	7,210
November 29	0	196	324	1,320	1,520	4.6	1,480	5,260	6,060
November 30	0	168	370	2,060	1,590	5.0	3,160	17,600	13,500
December 4	0	188	226	2,080	1,520	4.7	2,840	16,000	11,700
December 8	0	249	476	944	2,250	4.0	760	1,940	4,620
December 10	0	157	506	740	2,400	3.9	680	1,360	4,420
December 17	0	242	654	436	2,690	3.8	500	588	3,630
December 18	0	231	674	1,310	2,710	3.8	460	1,620	3,360
December 19	0	256	696	608	2,750	3.7	440	722	3,270
December 20	0	221	794	624	2,930	3.7	440	740	3,480
December 25	0	154	787	224	2,780	3.6	240	145	1,800
December 31	0	150	830	380	2,940	3.7	400	411	3,170
January 1	0	229	403	732	2,020	3.6	400	790	2,180
January 4	0	122	825	516	2,920	3.6	360	502	2,840
January 7	0	166	894	292	3,030	3.6	330	260	2,700
January 9	0	222	780	988	2,660	4.4	1,020	2,720	7,350
January 12	0	220	558	540	2,540	4.0	700	1,020	4,820
January 19	0	326	689	480	2,690	5.5	3,300	4,280	23,900
January 27	0	262	506	504	2,420	3.8	550	749	3,600
January 28	0	267	552	992	2,590	3.8	470	1,260	3,290
January 31	0	248	620	788	2,610	4.2	820	1,740	5,780
February 1	0	220	516	840	2,320	4.1	770	1,740	4,820
February 2	0	229	558	864	2,470	3.8	550	1,280	3,660
February 4	0	286	630	296	2,690	3.9	600	480	4,350
February 5	0	210	672	448	2,690	3.6	380	460	2,760
February 6	0	220	548	116	2,600	3.6	380	119	2,660
February 7	0	243	919	372	3,410	3.8	480	482	4,420
February 8	9	248	682	548	2,760	3.9	590	874	4,410
February 9	5	238	676	444	2,740	4.0	620	744	4,580
February 11	0	253	609	664	2,540	3.8	500	896	3,430
February 12	9	238	697	284	2,740	3.6	400	307	2,940
February 14	0	243	769	288	2,910	3.6	350	272	2,750
February 15	9	215	785	188	3,000	3.5	320	163	2,590
February 16	9	224	790	380	3,000	3.5	320	329	2,590
February 17	9	205	836	272	3,020	3.5	320	235	2,610
February 18	0	224	847	292	3,090	3.5	320	253	2,670
February 19	0	229	873	104	3,200	3.5	320	90	2,770
February 20	9	191	873	192	3,120	3.5	350	181	2,950
February 21	9	215	883	136	3,120	3.4	320	118	2,700
February 22	0	215	950	196	3,260	3.5	350	185	3,090
February 23	9	210	987	120	3,340	3.4	320	104	2,890
February 24	9	200	960	156	3,240	3.5	340	143	2,980
February 25	5	200	966	184	3,280	3.5	340	169	3,010
February 26	5	210	955	232	3,240	3.4	350	219	3,060
February 27	0	220	966	196	3,260	3.4	350	185	3,080
February 28	5	210	960	136	3,280	3.5	380	140	3,360
March 1	9	210	935	216	3,200	3.6	460	269	3,980
March 2	5	220	893	280	3,060	3.8	550	416	4,550
March 3	5	215	898	228	3,010	3.7	500	308	4,060
March 4	5	215	795	236	2,870	3.7	500	319	3,870
March 5	0	220	826	272	2,980	3.6	450	330	3,610
March 6	0	229	888	176	3,130	3.5	400	190	3,380
March 7	0	220	940	168	3,140	3.5	400	182	3,390
March 9	0	220	930	212	3,040	3.6	440	252	3,610
March 10	0	220	971	140	3,280	3.5	400	151	3,540
March 11	9	186	1,000	24	3,380	3.5	400	26	3,650
March 13	9	181	1,040	40	3,430	3.5	350	38	3,240
March 14	0	190	991	160	3,220	3.5	350	151	3,040
March 15	0	153	1,030	116	3,350	3.4	300	94	2,710
March 16	0	190	1,070	52	3,460	3.4	250	35	2,340
March 17	0	153	1,080	200	3,440	3.4	260	140	2,410
March 18	0	200	1,030	32	3,540	3.4	260	22	2,480
March 19	0	210	1,060	52	3,540	3.4	250	35	2,390

NOTE.—The first 11 samples listed above, May 20–July 29, 1905, were taken at the railroad bridge a few miles below the dam site.

Relative amount of substances in solution in water from North Fork of Red River at Navajo dam site, near Headrick, Okla.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium (Na+K).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905–1907.											
May 20–June 24	27	+1.3	2,940	10	2.0	21	0.00	5.7	26	33	0.001
June 25–July 22	28	−1.1	5,160	9.7	1.9	23	.00	3.0	22	42	.000
July 23–September 30	26	+3.0	3,870	9.9	1.8	23	.00	3.6	25	34	.001
August 14–October 11	27	.....	4,900	.....	1.8	25	.00	3.3	22	38	.000
October 14–November 25	25	.....	5,480	.....	1.9	.....	.00	3.4	19	39	.001
November 26–December 16	19	.....	3,320	.....	1.8	22	.00	5.4	22	36	.000
December 17–January 23	24	−0.3	4,040	7.4	2.0	24	.00	5.1	20	39	.001
February 7–28	12	+1.0	4,980	7.2	2.0	25	.42	5.1	19	38	.000
April 1–30	15	−2.5	3,400	7.4	2.1	21	.00	5.9	22	35	.000
March 2–27	17	−0.1	6,290	5.3	2.0	26	.00	3.7	17	41	.000
May 1–31	24	.....	2,640	.....	.....	12	.38	6.0	29	27	.000
June 1–30	28	−1.4	2,790	15	2.7	12	.00	5.9	30	28	.000
July 1–31	28	+0.0	2,480	11	2.1	18	.00	6.3	28	28	.000
August 1–31	30	+3.1	2,520	13	2.1	17	.00	5.7	32	25	Tr.
September 1–30	19	−0.4	2,550	11	2.2	19	.00	6.4	30	30	.035
October 10–31	16	−1.4	2,690	11	2.1	19	.00	7.3	30	30	.003
November 2–30	18	−0.1	3,020	10	2.5	20	.00	6.5	28	31	.029
December 4–January 31	18	+0.4	2,570	11	3.2	16	.00	6.8	34	25	.000
February 1–28	25	−0.1	2,870	10	3.2	18	.00	7.1	32	27	.008
March 1–19	17	+0.8	3,230	9.2	3.3	20	.00	4.3	31	30	.....
Mean	.....	1.1	3,590	10	2.2	20	.04	5.3	26	33	.004

Monthly discharge, in second-feet, of North Fork of Red River near Headrick, Okla.

Month.	1905.	1906.	1907.	1908.	Mean.
January	.....	140	817	349	435
February	.....	95	425	285	268
March	.....	42	304	215	187
April	.....	497	270	.....	384
May	.....	797	1,260	.....	1,030
June	.....	610	2,130	.....	1,370
July	[a] 218	697	410	.....	442
August	432	625	547	.....	535
September	292	833	182	.....	436
October	29	599	1,740	.....	789
November	251	592	343	.....	395
December	175	979	348	.....	501
Mean	.....	542	731	.....	564

[a] Approximate.

NORTH PLATTE RIVER NEAR FORT LARAMIE, WYO.

Samples of water were collected from North Platte River near Fort Laramie, Wyo., from May 21, 1906, to April 20, 1907. A gaging station was established by the United States Geological Survey at Guernsey, Wyo., about 15 miles above Fort Laramie, June 14, 1900. Stream-flow data, including gage heights, rating tables, and esti-

mates of discharge, for the gaging station have been published by the Survey in the following reports:

Annual Report 22, IV, 312.

Water-Supply Papers: 49, p. 275; 52, p. 516; 66, pp. 27, 171; 75, pp. 125-126; 84, pp. 68–70; 99, pp. 165–167; 131, pp. 35–38; 172, pp. 196–199; 208, pp. 142–144; 246, pp. 231–234.

Partial analyses, gage heights, and rates of discharge of water and solids for North Platte River near Fort Laramie, Wyo.

[Drainage area, 16,200 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1906–7.									
May 21	0	105	16	578	232	4.2	6,870	10,700	4,300
May 26	0	128	10	2,980	212	4.8	8,460	68,000	4,850
May 28	0	121	10	2,580	232	5.7	11,000	76,600	6,890
June 4	0	108	6	640	220	5.1	9,360	16,200	5,560
June 11	0	108	6	260	212	5.0	8,860	6,220	5,070
June 18	0	89	8	392	148	5.7	11,000	11,600	4,400
June 25	0	83	14	264	124	4.4	7,390	5,270	2,470
June 28	6	70	12	752	156	4.0	6,240	12,700	2,630
July 9, 10, 11, 12, 13, 14	0	98	10	800	214	2.9	3,820	8,260	2,210
July 16, 17, 18, 19, 20, 21	19	86	10	2,180	338	2.9	3,950	23,300	3,600
July 22, 23, 24, 25, 26, 27, 28	13	96	15	334	316	2.2	2,640	2,380	2,250
July 29, 30, 31, August 2, 3	19	82	15	74	320	1.5	1,420	284	1,230
August 5, 7, 8, 9, 10, 11	19	85	25	1,430	366	1.5	1,230	4,770	1,220
August 13, 14, 15, 17, 18	0	154	20	336	424	1.7	1,700	1,540	1,950
August 19, 20, 21, 22, 23, 25	0	154	20	1,630	402	1.6	1,520	6,700	1,650
August 24, 26, 27, 29, 31, September 1	0	156	17	2,490	396	1.2	970	6,510	1,040
September 4, 5, 7, 8	0	153	23	300	408	0.8	490	397	540
September 9, 10	12	137	18	210	412	0.8	530	301	590
September 21, 22	0	154	29	288	514	1.1	802	624	1,010
September 25, 27, 28, 29	0	144	17	578	398	1.0	698	1,090	751
October 1, 2, 3, 4, 5, 6	6	143	19	108	420	0.9	585	171	664
October 17, 19, 20	7	137	15	124	406	0.8	530	178	581
October 21, 22, 23	0	147	24	602	412	0.9	630	1,020	700
October 28, 29, 30, 31, November 1, 3	0	160	18	792	388	1.2	928	1,980	972
November 4, 5, 6, 7, 8, 9	0	162	97	354	414	1.6	1,500	1,430	1,680
November 11, 12, 13, 14, 15, 17	0	136	21	228	352	1.5	1,320	813	1,260
November 19, 20, 21, 22, 23, 24	14	140	19	204	398	1.3	1,170	645	1,260
November 25, 26, 27, 28, 29, 30, December 1	0	175	24	62	456	1.3	1,090	183	1,340
December 2, 3, 4, 5, 7, 8	0	164	21	308	368	1.5	1,340	1,110	1,330
December 9, 11, 12, 13, 14, 15	0	149	17	544	302	1.7	1,710	2,510	1,400
December 16, 17, 18, 19, 20, 21, 22	0	163	23	144	416	1.5	1,350	525	1,520
December 23, 24, 25, 27, 28	0	176	18	138	448	1.5	1,420	529	1,720
December 30, 31, January 1, 2, 3, 4, 5	0	167	15	130	382	0.9	.....	.....	.....
January 6, 7, 8, 9, 10, 11, 12	4	168	31	190	416	1.0	.....	.....	.....
January 14, 15, 16, 17, 18, 19	3	174	26	80	530	1.1	.....	.....	.....
January 20, 21, 22, 23, 24, 26	0	196	23	110	482	.....	.....	.....	.....
January 25, 27, 28, 30, 31	0	174	26	120	414	.....	.....	.....	.....
February 3, 5, 6, 7, 8, 9	0	169	21	70	480	.....	.....	.....	.....
February 10, 11, 12, 13, 14, 15, 16	0	119	16	406	374	.....	.....	.....	.....
February 17, 18, 19, 20, 21, 23	0	128	18	916	360	.....	.....	.....	.....
February 24, 25, 26, 28, March 1, 2	0	138	21	922	370	.....	.....	.....	.....
March 3, 4, 5, 6, 7, 8, 9	0	143	21	440	394	1.3	1,110	1,320	1,180
March 10, 11, 12, 13, 14	0	141	23	482	390	1.5	1,310	1,700	1,380
March 15, 16, 17, 18, 20, 21, 22, 23	5	134	26	940	410	1.8	1,850	4,690	2,050
March 24, 25, 26, 27, 29, 30	0	143	16	3,450	320	3.5	6,080	56,600	5,250
March 31, April 1, 2, 3, 5, 6	0	119	13	326	250	2.5	3,160	2,780	2,130
April 7, 8, 12, 13	0	119	15	230	260	2.3	2,800	1,740	1,960
April 14, 15, 16, 17, 18, 19, 20	0	114	14	426	248	2.9	4,470	5,130	2,990

Relative amount of substances in solution in water from North Platte River near Fort Laramie, Wyo.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1906–7.											
July 9–August 3	24	−4.3	272	17	4.4	5.9	0.00	46	34	3.6	0.00
August 5–September 1	23	+3.0	364	18	4.9	10	.00	43	37	5.5	.01
September 4–29	12	.....	418	17	4.8	.....	.00	37	38	5.3	.08
October 1–November 3	18	+4.1	434	16	4.1	12	.00	36	38	4.6	.00
November 4–December 1	25	+6.6	394	19	4.6	12	.00	39	39	5.8	.00
December 2–23	24	+5.0	440	16	4.3	11	.00	37	36	4.5	.04
December 30–January 26	26	+4.6	498	16	4.4	12	.00	37	38	5.2	.04
January 25–February 23	24	+5.5	420	16	4.0	11	1.1	35	34	5.0	.05
February 24–March 23	26	+6.6	424	15	4.2	12	.00	33	36	4.2	T.
March 24–April 20	23	.....	366	16	3.8	8.3	.00	32	.....	4.4	.00
Mean	.....	5.0	403	17	4.4	10	.11	38	37	4.8	.02

Monthly discharge, in second-feet, of North Platte River near Guernsey, Wyo.

Month.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	Mean.
January	.....	.....	.....	987	1,080	.....	.....	.....	.....	1,030
February	.....	.....	.....	897	.....	.....	.....	.....	.....	897
March	.....	.....	.....	1,450	1,190	.....	.....	[d] 2,720	1,090	1,610
April	.....	2,070	1,880	2,710	1,710	2,540	4,140	3,650	1,960	2,580
May	.....	8,590	5,560	4,670	6,080	6,740	6,580	6,430	4,690	6,170
June	[a] 6,360	9,150	6,130	8,480	9,320	10,600	8,990	13,300	10,500	9,200
July	1,770	1,900	1,300	2,630	2,800	3,290	3,510	7,510	2,240	2,990
August	483	706	400	635	715	1,040	1,350	1,850	1,150	925
September	[b] 289	316	196	665	488	382	672	994	583	509
October	.....	.....	436	980	652	435	629	981	614	675
November	.....	.....	516	869	503	559	1,270	1,100	670	784
December	.....	.....	663	882	[c] 589	.....	.....	.....	.....	711
Mean	.....	.....	.....	2,160	.....	.....	.....	.....	.....	2,340

[a] June 14–30.
[b] September 1–13.
[c] December 1–15.
[d] Approximate.

OWENS RIVER NEAR ROUND VALLEY, CAL.

Samples of water were collected from Owens River at a footbridge near Round Valley, Cal., from May 13, 1906, to April 27, 1907. A gaging station was established by the United States Geological Survey near Round Valley August 3, 1903. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for the gaging station have been published by the Survey in the following reports:[a]

Water-Supply Papers: 100, pp. 206–207; 134, pp. 200–203; 177, pp. 50–52; 213, pp. 35–37; 251, pp. 53–55.

Additional information in regard to the quality of the water of Owens River near Round Valley is contained in Water-Supply Paper 237, "Quality of California surface waters," pages 118–119.

[a] See also Third Ann. Rept., U. S. Reclamation Service, p. 200.

Partial analyses, gage heights, and rates of discharge of water and solids for Owens River at footbridge near Round Valley, Cal.

[Drainage area, 400 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1906–7.									
May 13, 14, 15, 17, 18, 19	0	112	19	28	210	2.5	340	26	193
May 20, 21, 22, 23, 24, 25, 26	0	102	15	10	214	3.5	368	10	213
May 27, 28, 29, 30, 31, June 1, 2	0	137	25	18	246	2.4	336	16	223
June 3, 4, 5, 7, 8, 9	0	83	20	34	170	2.8	456	42	209
June 10, 11, 12, 13, 14, 15, 16	0	76	10	70	130	3.4	645	122	226
June 19, 20, 21, 22, 23	0	88	10	40	154	3.7	747	81	310
June 24, 25, 26, 27, 28, 29, 30	0	88	10	52	154	3.7	763	107	317
July 1, 2, 3, 4, 5, 6, 7	0	80	10	64	176	3.5	673	116	320
July 30, 31, August 1, 2, 3, 4	0	82	10	12	182	3.5	686	22	337
August 5, 6, 8, 9, 10, 11	19	46	15	86	174	3.3	606	141	285
August 12, 13, 14, 15, 17, 18	0	85	15	66	164	3.0	526	94	233
August 19, 20, 21, 22, 23, 24, 25	0	101	17	68	134	3.0	514	94	186
August 26, 27, 28, 29, 30, 31, September 1	0	106	18	74	114	2.6	390	78	120
September 2, 3, 4, 5, 6, 7, 8	0	91	18	12	162	2.6	374	12	163
September 9, 10, 11, 12, 13, 14	7	98	17	28	188	2.4	338	26	172
September 16, 17, 18, 19, 20, 21, 22	0	120	22	26	222	2.4	314	22	188
September 23, 24, 25, 26, 27, 28, 29	0	88	16	0	232	2.3	291	0	182
September 30, October 1, 2, 3, 4, 5, 6	0	112	17	6	200	2.3	303	5	162
October 7, 8, 9, 10, 11, 12, 13	0	124	22	22	232	2.3	287	17	180
October 14, 15, 16, 17, 18, 19, 20	0	129	23	30	202	2.2	268	22	146
October 21, 22, 23, 24, 25, 26, 27	0	128	21	84	198	2.1	248	56	133
October 28, 29, 30, 31, November 1, 2, 3	7	125	26	50	272	2.1	253	34	186
November 4, 5, 6, 7, 8, 9, 10	0	54	7	54	68	2.1	251	37	46
November 11, 12, 13, 14, 15, 16, 17	0	138	16	46	210	2.1	237	29	134
November 18, 19, 20, 21, 22, 23, 24	3	120	27	8	202	2.0	218	5	119
November 25, 26, 27, 28, 29, 30	1	135	31	10	228	2.1	242	7	149
December 2, 3, 4, 5, 6, 7, 8	0	150	30	70	240	2.1	238	45	154
December 9, 10, 11, 12, 13, 14, 15	0	160	34	40	228	2.2	266	29	164
December 16, 17, 18, 19, 20, 21, 22	0	170	35	28	316	2.2	259	20	221
December 23, 24, 25, 26, 27, 28, 29	0	223	47	14	402	2.2	263	10	286
December 30, 31, January 1, 2, 3, 4, 5	0	157	38	56	270	2.1	235	36	171
January 6, 7, 8, 9, 10, 11, 12	0	162	36	86	268	2.0	224	52	162
January 13, 14, 15, 16, 17, 18, 19	0	162	33	30	274	2.2	257	21	190
January 20, 21, 22, 23, 24, 25, 26	0	164	36	34	286	2.2	263	24	203
January 27, 28, 29, 30, 31, February 1, 2	0	173	38	66	258	2.2	270	48	188
February 3, 4, 5, 6, 7, 8, 9	0	176	40	0	312	2.3	296	0	250
February 10, 11, 12, 13, 14, 15, 16	9	241	62	24	410	2.2	274	18	303
February 17, 18, 19, 20, 21, 22, 23	5	241	57	54	410	2.3	285	42	315
February 24, 25, 26, 27, 28, March 1, 2	5	152	36	18	280	2.2	270	13	204
March 3, 4, 5, 6, 7, 8, 9	0	205	46	36	344	2.3	297	29	276
March 10, 11, 12, 13, 14, 15, 16	9	200	44	238	352	2.2	278	179	264
March 17, 18, 19, 21, 22, 23	14	172	46	90	410	2.9	488	119	540
March 24, 25, 26, 27, 28, 29, 30	14	253	59	60	492	2.4	326	53	433
March 31, April 1, 2, 3, 4, 5, 6	5	129	31	62	280	.....	.....	.....	.....
April 7, 8, 9, 10, 11, 12, 13	0	126	26	34	240	.....	.....	.....	.....
April 14, 15, 16, 17, 18, 19, 20	0	119	25	20	210	.....	.....	.....	.....
April 21, 22, 23, 24, 25, 26, 27	0	122	21	22	216	.....	.....	.....	.....

Relative amount of substances in solution in water from Owens River at footbridge near Round Valley, Cal.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1906–7.											
May 13–June 9	24	−1.8	198	11	2.2	18	0.00	63	9.1	11	0.00
June 10–July 7	26	+8.3	154	17	2.9	17	.00	62	11	12	.01
July 30–August 25	25	.....	152	14	2.6	22	.00	.....	12	9.9	.01
August 26–September 22	27	.....	186	10	3.4	.....	.00	58	10	9.1	.02
September 23–October 20	28	−2.1	228	7.9	2.0	21	.00	54	16	11	.01
October 21–November 17	28	.....	208	7.7	4.0	26	.00	.....	12	.....	.00
November 25–December 15	27	− .7	256	7.8	2.3	20	.00	55	11	12	.11
December 16–January 12	28	+6.2	348	6.9	1.7	26	.00	53	8.6	13	.00
January 13–February 9	28	+4.4	314	6.7	2.1	24	.00	55	7.6	13	.01
February 10–March 9	28	+3.7	380	6.3	1.8	27	.00	58	7.9	14	T.
March 10–April 6	27	.....	392	6.9	2.2	27	2.4	51	7.7	.....	.....
April 7, 27	21	+2.5	222	12	2.3	19	.00	55	10	11	.....
Mean	.....	3.7	253	9.5	2.5	22	.20	56	10	12	.02

Monthly discharge, in second-feet, of Owens River near Round Valley, Cal.

Month.	1903.	1904.	1905.	1906.	1907.	1908.	Mean.
January	.....	157	193	199	247	227	205
February	.....	221	196	205	281	223	225
March	.....	260	213	270	341	279	273
April	.....	202	177	345	270	242	247
May	.....	300	246	328	438	274	317
June	.....	532	392	624	616	313	495
July	.....	428	275	696	856	289	509
August	[a] 169	336	169	535	432	264	317
September	167	281	180	330	305	222	247
October	172	266	180	273	285	192	228
November	163	246	197	239	252	184	214
December	161	218	179	256	245	182	207
The year	.....	287	216	358	381	241	290

[a] August 4–31.

OWENS RIVER NEAR TINEMAHA, CAL.

Samples of water were collected from Owens River at the intake of the proposed Los Angeles aqueduct near Tinemaha, Cal., from November 6, 1906, to April 14, 1907. A gaging station was established near Tinemaha by the United States Geological Survey September 20, 1906, and measurements of the stream at this point were made previous to that date by the city of Los Angeles. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for the gaging station have been published by the Survey in the following reports:

Water-Supply Papers: 213, pp. 38–39; 251, pp. 56–58.

Additional information in regard to the quality of the water of Owens River near Tinemaha is contained in Water-Supply Paper 237, "Quality of California surface waters," pages 120–121.

Partial analyses, gage heights, and rates of discharge of water and solids for Owens River at the intake of the Los Angeles aqueduct, near Tinemaha, Cal.

Dates.	Analysis (milligrams per liter).										Gage height (feet).	Discharge (second-feet).	Solids (tons per day).	
	Calcium radicle (Ca).	Magnesium radicle (Mg).	Sodium and potassium radicles ($Na_3+\frac{3}{4}K$).	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Sulphate radicle (SO_4).	Chlorine radicle (Cl).	Nitrate radicle (NO_3).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1906–7.														
November 6	28	8	59	0	163	44	27	0.00	44	280	2.00	418	50	316
November 15	30	10	64	0	152	38	31	.00	88	272	2.05	426	102	313
November 27	31	9	68	0	151	43	35	.00	72	296	2.10	434	84	347
December 8	31	10	87	0	186	52	40	.00	48	364	2.60	524	68	515
December 16	.....	.....	99	0	235	43	51	.00	150	410	2.70	542	220	600
December 23	31	10	84	0	205	41	44	.02	110	344	2.35	479	142	445
December 30	36	11	95	0	235	57	51	.00	44	438	2.70	542	64	641
January 6	36	12	82	0	194	.....	41	.09	142	372	2.50	451	173	453
January 13	37	12	108	0	238	57	62	.04	206	464	3.00	561	312	702
January 20	.....	.....	83	0	201	47	46	.00	74	374	2.70	494	99	499
January 27	.....	.....	96	0	210	50	51	.00	124	392	2.70	494	165	523
February 3	32	11	94	0	221	43	51	.00	152	354	3.00	561	230	536
February 10	32	10	.....	0	224	.....	52	.00	26	410	2.90	538	38	595
February 17	31	10	96	0	.....	41	.....	.00	70	370	2.40	430	81	430
February 24	38	10	98	0	.....	39	47	.00	84	376	2.60	472	107	480
March 3	34	10	91	0	219	37	47	Tr.	36	394	2.30	410	40	436
March 10	41	.....	136	0	269	57	72	Tr.	130	500	2.65	483	170	652
March 17	26	8	99	0	217	51	49	Tr.	100	376	2.45	440	119	447
March 24	30	7	104	0	224	34	46	.00	216	394	4.80	1,020	595	1,080
March 31	35	9	95	0	.....	39	.....	.22	70	360	2.90	538	102	523
April 7	32	10	78	0	186	35	.....	Tr.	92	326	2.40	430	107	379
April 14	33	10	74	0	181	39	32	Tr.	114	294	1,60	286	88	227
Mean	33	10	90	0	206	44	46	.02	100	371	2.61	499	143	506

Relative amount of substances in solution in water from Owens River at the intake of the Los Angeles aqueduct, near Tinemaha, Cal.

Dates.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
			Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1906–7.										
November 6	+3.1	280	10	2.9	21	0.00	58	16	9.6	0.00
November 15	+9.8	272	11	3.5	24	.00	56	14	11	.00
November 27	+9.3	296	10	3.0	23	.00	51	15	12	.00
December 8	+7.5	364	8.5	2.6	24	.00	51	14	11	.00
December 16	.....	410	.....	.....	24	.00	57	10	12	.00
December 23	+4.8	344	9.0	2.8	24	.00	60	12	13	.01
December 30	+2.6	438	8.2	2.5	22	.00	54	13	12	.00
January 6	.....	372	9.7	3.2	22	.00	52	.....	11	.02
January 13	+4.9	464	8.0	2.6	23	.00	51	12	13	.01
January 20	.....	374	.....	.....	22	.00	54	13	12	.00
January 27	.....	392	.....	.....	24	.00	54	13	13	.00
February 3	+4.9	354	9.0	3.1	27	.00	62	12	14	.00
February 10	.....	410	7.8	2.4	.....	.00	55	.....	13	.00
February 17	.....	370	8.4	2.7	26	.00	.....	11	.....	.00
February 24	.....	376	10	2.6	26	.00	.....	10	12	.00
March 3	+6.5	394	8.6	2.5	23	.00	56	9.4	12	Tr.
March 10	.....	500	8.2	.....	27	.00	54	11	14	Tr.
March 17	+2.3	376	6.9	2.2	26	.00	58	14	13	Tr.
March 24	+7.3	394	7.6	1.7	26	.00	57	8.6	12	.00
March 31	.....	360	9.7	2.6	26	.00	.....	11	.....	.01
April 7	.....	326	9.8	2.9	24	.00	57	11	.....	Tr.
April 14	+9.8	294	11	3.4	25	.00	62	13	11	Tr.
Mean	6.1	371	9.0	2.7	24	.00	56	12	12	Tr.

Partial sanitary analyses of water from Owens River at the intake of the Los Angeles aqueduct, near Tinemaha, Cal.

[Milligrams per liter.]

Dates.	Nitrogen as—				Oxygen consumed.	Dissolved solids.
	Free ammonia.	Albuminoid ammonia.	Nitrites.	Nitrates.		
1906–7.						
November 27	0.062	0.114	0.000	0.000	1.80	310
January 21	.024	.134	.002	.005	3.64	408
February 20	.140	.270	Trace.	Trace.	2.20	396
March 20	.131	.200	Trace.	Trace.	4.88	416
Mean	.089	.180	Trace.	Trace.	3.13	382

Monthly discharge, in second-feet, of Owens River at the intake of the Los Angeles aqueduct, near Tinemaha, Cal.

Month.	1906.	1907.	1908.	Mean.
January	436	500	539	492
February	358	493	584	478
March	438	646	485	523
April	388	315	145	283
May	200	264	58	174
June	729	660	57	482
July	2,230	1,280	188	1,230
August	1,210	698	274	727
September	448	310	173	310
October	339	460	298	366
November	423	538	397	453
December	510	527	409	482
The year	642	558	300	500

PALOUSE RIVER NEAR HOOPER, WASH.

Samples of water were collected from Palouse River near Hooper, Wash., from May 22 to October 8, 1905. A gaging station was established by the United States Geological Survey near Hooper April 1, 1897. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for the gaging station have been published by the Survey in the following reports:

Annual Reports: 19, IV, p. 460; 20, IV, pp. 62, 489–490; 21, IV, pp. 414–415; 22, IV, p. 452.

Water-Supply Papers: 16, p. 172; 28, pp. 155, 162, 168, 170; 38, pp. 360–361; 39, p. 454; 51, pp. 443–444; 52, p. 522; 66, pp. 136–137, 177; 75, p. 206; 85, pp. 203–205; 100, pp. 413–415; 135, pp. 243–247; 178, pp. 171–173; 214, pp. 119–121; 252, pp. 281–283.

Partial analyses, gage heights, and rates of discharge of water and solids for Palouse River near Hooper, Wash.

[Drainage area, 2,210 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine-radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905.									
May 22, 23, 24, 25, 26	0	81	8	90	146	2.5	300	73	118
May 28, 29, 30, June 1, 2	0	66	5	82	108	2.9	386	85	113
June 5, 6, 7, 8, 9	0	86	14	34	164	2.9	419	38	185
June 11, 12, 13, 14, 15, 16, 17	0	72	15	34	134	2.4	279	26	101
June 18, 19, 20, 21, 22, 23, 24	0	83	6	46	126	1.8	154	19	52
June 25, 26, 28, 29, 30, July 1	0	97	18	68	148	1.8	156	29	62
July 2, 3, 4, 5, 6	0	95	8	100	134	1.7	135	36	49
July 7, 8, 9, 10, 12, 13, 14, 15	0	112	9	52	218	1.3	76	11	45
July 16, 17, 18, 20, 21, 22	0	133	23	4	166	1.2	57	1	26
July 23, 24, 25, 26, 27, 28, 29	7	126	13	14	182	1.0	42	2	21
July 30, 31, August 1, 2, 3, 4, 5	18	106	9	20	164	0.8	32	2	14
August 6, 7, 8, 9	0	142	9	0	188	0.8	30	0	15
August 14, 15, 16, 17, 18, 19	0	148	13	64	162	0.8	27	5	12
August 21, 22, 23, 24, 25, 26	0	145	6	40	158	0.7	24	3	10
August 27, 28, 29, 30, 31, September 1, 2	0	169	5	12	202	0.7	23	1	13
September 3, 4, 5, 6, 7, 8, 9	0	154	11	30	148	0.6	20	2	8
September 10, 11, 12, 13, 14, 15, 16	0	136	13	40	162	0.6	21	2	9
September 17, 18, 19, 20, 22, 23	0	159	10	38	166	0.7	24	2	11
September 24, 25, 26, 28, 29, 30	0	160	11	20	202	0.7	26	1	14
October 4, 5, 6, 7, 8	0	329	18	32	632	1.3	73	6	125

Relative amount of substances in solution in water from Palouse River near Hooper, Wash.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3)
1905.											
May 22–June 17	22	.....	116	12	5.3	17	0.00	64	.....	5.4	0.11
June 18–July 15	26	+4.9	136	19	5.6	8.8	.00	71	15	5.7	.13
August 14–September 9	26	.....	183	.....	6.0	15	.00	84	11	4.6	.10
September 10–October 8	24	+1.4	243	14	5.8	19	.00	78	23	6.2	.18
Mean	.....	3.2	170	15	5.7	15	.00	74	16	5.5	.13

Monthly discharge, in second-feet, of Palouse River near Hooper, Wash.

Month.	1897.	1898.	1899.	1900.	1901.	1902.	1904.	1905.	1906.	1907.	1908.	Mean.
January	.....	1,040	1,130	.....	1,080	216	409	181	319	1,240	.....	702
February	.....	3,190	1,360	.....	1,530	1,090	873	225	878	4,820	.....	1,750
March	.....	2,140	1,370	.....	2,100	716	4,300	348	964	3,550	.....	1,940
April	.....	2,410	1,890	568	861	370	3,350	380	943	a 2,570	.....	1,480
May	.....	733	827	392	248	515	678	294	253	.....	.....	492
June	.....	305	176	142	176	150	258	258	279	.....	a 172	212
July	.....	100	51	34	73	178	79	74	75	.....	56	80
August	.....	33	24	21	9	75	24	27	27	.....	26	30
September	a 64	30	27	20	7	62	17	22	30	.....	25	30
October	57	46	49	93	8	67	28	82	34	.....	53	52
November	357	83	110	89	23	118	40	77	235	.....	67	120
December	1,420	99	718	811	74	452	63	126	1,470	.....	82	532
The year	.....	850	644	.....	515	334	844	175	459	.....	.....	618

a Approximate.

PAYETTE RIVER NEAR HORSESHOE BEND, IDAHO.

Samples of water were collected from Payette River at Jerusalem, near Horseshoe Bend, Idaho, from May 15 to September 15, 1906. A gaging station was established by the United States Geological Survey at Jerusalem February 13, 1906. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for the gaging station have been published by the Survey in the following reports:

Water-Supply Papers: 214, pp. 97–98; 252, pp. 253–256.

Partial analyses, gage heights, and rates of discharge of water and solids for Payette River at Jerusalem, near Horseshoe Bend, Idaho.

[Drainage area, 2,240 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1906.									
May 15	0	13	4	40	76	8.1	9,550	1,030	1,960
May 17	0	26	6	20	72	7.6	8,150	440	1,590
May 18	0	19	6	4	84	7.2	7,070	76	1,600
June 16	0	26	6	40	60	7.5	7,880	852	1,280
June 17	0	26	8	32	72	7.6	8,150	704	1,580
June 27	0	26	8	24	64	6.5	5,260	341	908
June 28	0	26	10	12	76	7.0	6,540	212	1,340
June 29	0	38	6	140	76	6.9	6,280	2,370	1,290
June 30	0	26	6	8	76	6.8	6,020	130	1,240
July 2, 4, 5, 6, 7	0	29	10	52	52	6.2	4,550	640	640
July 8, 10, 11, 12, 13, 14	0	35	5	0	64	5.7	3,530	0	610
July 15, 16, 17, 18, 19, 20	0	42	5	0	86	5.1	2,420	0	562
July 22, 23, 24, 25, 26, 27, 28	0	43	5	0	112	4.6	1,670	0	505
July 29, 30, August 1, 2, 3, 4	10	29	10	0	116	4.3	1,330	0	417
August 5, 6, 7, 8, 9, 10, 11	0	56	5	62	74	4.2	1,230	206	246
August 15, 16, 17, 18	0	62	8	0	100	4.1	1,130	0	305
August 19, 20, 21, 22, 23, 24, 25	0	51	9	20	46	4.0	1,030	56	128
August 26, 27, 28, 29, 30, September 1	0	48	9	0	64	4.0	1,030	0	178
September 2, 3, 4, 5, 6, 7, 8	0	53	7	24	46	3.8	850	55	106
September 9, 10, 11, 12, 13	0	48	7	8	46	3.8	850	18	106

Relative amount of substances in solution in water from Payette River at Jerusalem, near Horseshoe Bend, Idaho.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1906.											
July 2–28	24	+ 9.1	76	16	3.3	16	0.00	55	7.6	13	0.00
July 29–August 25	24	.....	88	18	6.6	.....	.00	52	12	11	.01
August 26–September 13	18	+ 9.4	96	15	4.9	17	.00	54	21	10	.00
Mean	.....	9.2	87	16	4.9	16	.00	54	14	11	T.

Monthly discharge, in second-feet, of Payette River near Horseshoe Bend, Idaho.

Month.	1906.	1907.	1908.	Mean.
January	.....	.....	1,150	1,150
February	[a] 1,090	[b] 3,010	1,050	1,720
March	1,930	5,550	2,230	3,240
April	4,960	9,790	6,200	6,980
May	7,260	13,400	7,040	9,230
June	6,560	13,100	7,560	9,070
July	2,900	7,980	4,480	5,120
August	1,120	2,720	1,430	1,760
September	894	1,420	1,250	1,190
October	859	1,180	1,530	1,190
November	2,130	1,130	1,420	1,560
December	.....	1,190	1,100	1,140
The year	.....	.....	3,040	3,610

[a] February 13–28. [b] February 17–28.

PECOS RIVER AT CARLSBAD, N. MEX.

Samples of water were collected from Pecos River at Green Street, Carlsbad, N. Mex., from May 22, 1905, to April 30, 1907. A gaging station was established at Carlsbad by the United States Geological Survey May 20, 1903, and discontinued March 31, 1908. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for the gaging station have been published by the Survey in the following reports:[a]

Water-Supply Papers: 99, pp. 358–360; 132, pp. 103–104; 174, pp. 102–105; 210, pp. 90–91; 248, pp. 125–126.

Further information relative to the quality of water of Pecos River at Carlsbad is contained in a paper entitled "Principles of water analysis," by Arthur Goss, in Bulletin 34, New Mexico Agricultural Experiment Station.

[a] See also Fourth Ann. Rept. U. S. Reclamation Service, pp. 271–272.

Partial analyses, gage heights, and rates of discharge of water and solids for Pecos River at Green Street, Carlsbad, N. Mex.

[Drainage area, 22,000 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–1907.									
May 22, 23, 24, 25, 26, 27	11	133	127	532	1,240	3.6	2,390	3,430	8,020
May 28, 29, 30, 31, June 1	10	115	189	150	1,610	3.3	2,070	840	9,020
June 10, 11, 12, 13, 14, 15, 16, 17	0	123	302	.....	.....	3.3	2,040	.....	.....
June 18, 19, 21, 22, 23	0	143	329	100	2,110	2.1	978	2,640	5,590
June 29, 30, July 1	0	163	506	210	3,160	1.2	305	173	2,600
July 2, 3, 5, 14, 15	0	167	503	372	2,920	1.2	297	298	2,350
July 16, 18, 19, 20, 21, 22	0	154	675	100	3,570	1.2	324	87	3,120
July 23, 24, 25, 26, 27, 28, 29	0	112	179	1,140	1,320	8.7	21,000	64,800	75,000
July 31, August 1, 2, 3, 4, 5	0	130	291	276	1,740	4.0	2,960	2,210	13,900
August 7, 8, 9, 10, 11	0	159	382	102	2,420	2.5	1,280	353	8,380
August 14, 15, 16, 17, 18, 19	13	151	348	136	2,110	2.0	896	329	5,100
August 20, 21, 22, 23, 24, 25	10	131	435	176	2,570	1.5	477	227	3,310
August 27, 28, 29, 30, 31, September 1, 2	0	159	623	98	3,350	1.2	320	85	2,900
September 3, 5, 6, 7, 8, 9	0	105	512	508	2,800	2.1	938	1,290	7,090
September 10, 11, 12, 14, 15, 19, 20	1	139	339	1,040	2,400	1.6	635	1,790	4,100
September 21, 22, 23, 24, 25, 26, 27	8	161	418	162	2,790	1.1	244	107	1,840
September 28, 29, 30, October 1, 2, 3, 4	0	151	523	226	3,060	1.4	408	249	3,380
October 6, 9, 10, 11, 12, 13, 14	7	153	475	304	2,830	1.1	255	209	1,950
October 15, 16, 17, 18, 19, 20, 21	12	156	424	204	2,770	1.1	270	149	2,020
October 23, 24, 25, 27, 28	0	180	424	120	2,790	1.2	281	91	2,120
October 26, 29, 30, 31, November 10, 11	8	169	425	12	2,820	1.2	287	9	2,190
November 13, 14, 15, 16, 17, 18	12	155	697	168	3,340	1.8	697	316	6,280
November 19, 20, 21, 22, 23, 24, 25	0	179	557	98	3,040	1.7	644	170	5,300
November 26, 27, 28, 29, 30, December 1, 2	0	158	412	1,480	2,580	2.6	1,360	5,430	9,450
December 3, 4, 5, 6, 7, 8, 9	0	171	313	834	2,100	2.1	941	2,120	5,350
December 10, 11, 12, 13, 14, 15	0	188	366	782	2,130	1.9	751	1,590	4,340
December 20, 22, 23, 25, 26, 29, 30	0	205	510	678	2,800	1.6	579	1,060	4,380
December 31, January 1, 2, 3, 4, 6	0	211	582	540	2,880	1.6	565	824	4,400
January 7, 8, 9, 10, 11, 12, 13	0	199	542	914	2,760	1.6	537	1,330	4,000
January 14, 15, 16, 17, 18, 19, 20	0	191	557	552	2,810	1.6	541	806	4,110
January 22, 23, 24, 25, 26, 27, 28	6	168	459	358	2,690	1.6	493	477	3,580
January 29, 30, 31, February 2, 3	0	185	470	294	2,650	1.6	492	390	3,520
February 4, 5, 6, 7, 8, 9, 10	0	205	470	312	2,620	1.5	473	398	3,340
February 11, 12, 13, 14, 15, 16, 17	0	197	614	448	2,950	1.6	514	623	4,090
February 18, 19, 20, 21, 22, 23, 24	0	192	570	384	3,010	1.6	493	512	4,010
February 25, 26, 27, 28, March 1, 2, 3	0	185	557	300	2,880	1.4	393	318	3,060
March 5, 6, 7, 8, 9	0	179	484	170	2,640	1.2	266	122	1,900
March 10, 12, 13, 14, 15, 17	19	179	367	32	2,710	1.0	183	16	1,340
March 18, 19, 21, 22, 23, 24	0	179	375	42	2,710	1.1	221	25	1,620
March 25, 26, 27, 28, 29, 30, 31	0	169	407	80	2,740	1.1	239	52	1,770
April 1, 2, 3, 4, 5, 6	0	.....	367	0	2,800	1.2	268	0	2,020
April 11, 12, 13, 14	0	153	387	0	2,980	1.2	252	0	2,030
April 15, 16, 17, 19, 20, 21	0	128	459	354	2,960	1.5	476	455	3,800
April 22, 23, 24, 25, 26	0	137	658	0	3,810	2.5	1,300	0	13,400
April 29, 30, May 1, 2, 3, 4, 5	0	109	382	496	2,290	1.9	809	1,080	5,020
May 6, 7, 8, 9, 10, 11, 12	0	156	381	370	2,580	1.2	270	270	1,880
May 13, 14, 15, 16, 17, 18, 19	0	137	397	0	3,020	1.2	295	0	2,410
May 20, 21, 22, 23, 24, 25, 26	0	221	333	158	2,400	2.2	1,020	435	6,600
May 27, 28, 29, 30, 31, June 1	0	125	347	184	2,400	1.4	433	215	2,810
June 10, 11, 12, 13, 14, 15, 16	0	99	436	164	2,710	1.7	644	285	4,710
June 17, 18, 19, 20, 21, 22, 23	0	99	431	204	2,960	1.2	297	164	2,370
June 25, 26, 27, 28, 29, 30	0	153	426	60	2,790	1.3	310	50	2,340
July 1, 2, 3, 4, 5, 6, 7	21	10	406	94	2,830	1.2	301	76	2,300
July 8, 10, 12, 14	0	134	351	134	2,250	2.0	861	312	5,230
July 15, 16, 17, 18, 19, 20, 21	0	77	233	70	1,760	3.2	2,100	396	9,960
July 22, 24, 25, 26, 27, 28	0	118	391	198	2,640	1.5	477	255	3,400
July 29, 30, 31, August 1, 2, 3, 4	0	85	461	176	3,170	1.2	268	128	2,290
August 5, 6, 8, 9, 10, 11	0	121	451	86	2,870	1.2	287	67	2,220
August 12, 13, 14, 15, 16	0	137	409	328	2,500	2.0	841	745	5,680

Partial analyses, gage heights, and rates of discharge of water and solids for Pecos River at Green Street, Carlsbad, N. Mex.—Continued.

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–1907.									
August 19, 20, 21, 22, 23	0	169	415	100	2,670	1.1	254	69	1,830
August 25, 26, 27, 28, 29, 30, 31, September 1	0	115	437	136	2,520	1.7	673	247	4,590
September 2, 3, 4, 5, 7, 8	12	146	365	140	2,790	1.0	205	78	1,540
September 10, 11, 13, 14	9	149	368	78	2,800	1.0	203	43	1,540
September 16, 17, 18, 19, 20, 22	0	160	375	88	2,770	1.0	202	47	1,560
September 23, 24, 25, 26, 27, 28, 29	0	163	369	104	2,770	1.1	212	60	1,590
September 30, October 1, 2, 3, 4	0	160	373	212	2,880	1.1	222	127	1,730
October 7, 8, 9, 11, 12, 13	0	157	355	34	2,830	1.1	215	20	1,640
October 14, 15, 17, 18, 19, 20	8	139	373	44	2,940	1.1	225	27	1,790
October 22, 23, 24, 25, 26, 27	0	157	353	150	2,710	1.1	229	93	1,670
October 28, 29, 30, 31, November 1, 2, 3	0	154	359	406	2,700	1.1	230	252	1,680
November 4, 5, 6	0	147	340	220	2,730	1.1	233	139	1,720
November 11, 12, 13, 14, 15, 16, 17	0	152	352	4	2,850	1.1	242	3	1,860
November 18, 19, 20, 22, 23, 24	0	161	396	16	2,880	1.2	284	12	2,200
November 25, 26, 27, 28, 30, December 1	10	39	594	192	3,020	2.8	711	369	5,810
December 2, 3, 4, 5, 6, 7, 8	0	161	902	138	3,660	2.8	1,580	588	15,600
December 9, 10, 11, 12, 13, 14	0	169	502	176	2,680	2.2	1,020	485	7,360
December 15, 16, 17, 18, 19, 20, 21, 22	0	168	450	164	2,670	1.3	341	151	2,460
December 23, 24, 25, 26, 27, 28, 29	0	163	459	28	2,880	1.1	222	17	1,730
December 30, 31, January 1, 2, 3, 4, 5	0	162	475	26	2,920	1.1	242	17	1,910
January 6, 7, 8, 9, 10, 11, 12	0	182	570	50	2,950	2.1	954	129	7,600
January 13, 14, 15, 16, 17, 18	0	167	553	90	2,890	1.6	594	144	4,630
January 19, 20, 21, 22, 23, 24, 25, 26	0	161	514	88	2,860	1.5	510	121	3,950
January 27, 28, 29, 30, 31, February 1, 2	0	169	541	530	2,410	1.7	631	903	4,110
February 3, 4, 5, 6, 7, 8, 9	5	141	480	200	2,780	1.2	275	149	2,070
February 10, 11, 12, 13, 14, 15, 16	5	148	503	54	2,650	1.6	590	86	4,230
February 17, 18, 19, 20, 21, 22, 23	0	155	501	232	3,030	1.2	275	172	2,250
February 24, 25, 26, 27, 28, March 1, 2	0	153	558	60	3,000	1.6	535	87	4,330
March 3, 4, 5, 6, 7, 8, 9	0	148	531	22	3,070	1.3	350	21	2,900
March 10, 11, 12, 13, 14, 15, 16	0	143	516	80	3,050	1.2	275	60	2,260
March 17, 18, 19, 20, 21, 22, 23	14	153	520	20	3,060	1.2	255	14	2,110
March 24, 25, 26, 27, 28, 29	0	136	490	2	2,870	1.0	180	1	1,400
March 30, 31, April 1, 2, 3, 6	0	148	.....	28	2,860	1.0	180	14	1,390
April 7, 8, 9, 10, 11, 12, 14	5	177	452	280	2,640	0.9	150	113	1,070
April 15, 16, 17, 18, 19, 20, 21	0	148	338	58	2,110	0.7	104	16	594
April 22, 23, 24, 25, 26, 27, 28, 29, 30	0	179	368	68	2,180	0.7	100	18	588

Relative amount of substances in solution in water from Pecos River at Green Street, Carlsbad, N. Mex.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905–1907.											
May 22–June 23	24	.....	1,740	.....	3.0	10	0.00	7.8	44	15	0.007
June 29–July 29	21	.....	2,850	14	4.3	[a]13	.00	5.4	.....	20	.000
July 31–August 25	23	+3.4	2,160	18	3.1	10	.00	6.6	45	16	.006
August 27–September 27	27	.....	2,810	.....	3.4	11	.00	5.6	42	17	.001
September 28–October 28	26	.....	2,970	.....	3.5	11	.00	5.7	43	16	.001
October 26–December 2	25	.....	2,850	14	.....	9.2	.00	6.1	43	18	.001
December 3–January 6	26	−2.7	2,460	13	4.1	11	.00	8.1	44	19	.000
January 7–February 3	26	−0.3	2,690	13	3.5	13	.00	6.8	40	19	.000
February 4–March 3	28	+1.4	2,920	12	3.4	13	.00	6.3	38	19	.000
March 3–29	27	+1.5	3,030	15	3.5	10	.16	4.9	43	16	.....
March 5–31	24	.....	2,770	.....	3.5	9.6	.00	6.4	43	14	.000
April 1–26	21	.....	2,880	.....	3.5	9.5	.00	3.9	46	16	.000
April 29–May 26	28	−1.0	2,580	14	3.2	9.8	.00	4.9	44	15	.000
May 27–June 30	26	+1.2	2,610	15	3.4	10	.00	3.2	46	16	.000
July 1–28	24	−3.5	2,310	15	3.3	8.3	.00	4.2	47	15	.000
July 29–August 23	23	+ .6	2,620	16	3.6	11	.00	5.0	48	17	.000
August 25–September 22	23	+2.1	2,740	15	3.7	10	.00	5.7	45	15	.001
September 23–October 20	24	−1.8	2,970	13	3.3	8.8	.00	5.3	43	14	Trace
October 22–November 17	23	.....	2,770	.....	3.5	10	.00	5.7	45	15	.000
November 18–December 14	25	.....	3,090	13	3.4	.....	.00	5.2	41	20	.004
December 15–January 12	29	+2.9	2,900	15	3.5	12	.00	5.6	44	17	.004
January 13–February 9	28	+ .5	2,960	14	3.7	11	.00	5.2	43	17	.000
February 10–March 2	21	+ .7	3,030	15	3.5	11	.00	5.2	43	18	.000
March 30–April 30	29	+1.9	2,490	15	3.7	10	.00	7.5	43	16	.....
Mean	.....	1.7	2,720	14	3.5	11	.01	5.7	44	17	.001

[a] Sodium is 85 per cent and potassium is 20 per cent of this amount.

Monthly discharge, in second-feet, of Pecos River at Carlsbad, N. Mex.

Month.	1899.[a]	1900.[a]	1901.[a]	1902.[a]	1903.[a]	1903.	1904.	1905.	1906.	Mean.
January	220	256	156	211	282	.....	99	392	528	268
February	301	164	197	140	280	.....	94	838	482	312
March	140	130	121	194	137	.....	85	1,270	240	290
April	172	171	238	165	79	.....	88	1,080	580	322
May	240	577	258	387	162	.....	84	1,570	552	479
June	207	447	293	350	1,330	[b] 1,960	91	1,260	511	717
July	356	242	629	312	184	164	96	5,240	884	901
August	355	398	55	707	203	93	132	1,160	499	400
September	236	1,130	182	528	71	83	152	486	207	342
October	78	418	76	237	99	82	[b] 4,270	308	217	643
November	39	248	88	1,410	52	82	695	739	327	409
December	243	90	162	248	24	80	[b] 521	742	744	317
Mean	216	356	205	407	242	.....	534	1,260	481	450

[a] Taken from Fourth Ann. Rept. U. S. Reclamation Service, p. 271. The figures represent the flow through the headgates and over the spillway at Avalon dam, but are approximately correct for Carlsbad.
[b] Approximate.

PECOS RIVER NEAR DAYTON, N. MEX.

Samples of water were collected from Pecos River below Penasco River near Dayton, N. Mex., from July 20, 1905, to April 20, 1907. A gaging station was established by the United States Geological Survey near Dayton March 24, 1905. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for the gaging station have been published by the Survey in the following reports:

Water-Supply Papers: 174, pp. 99–101; 210, pp. 83–85; 248, pp. 119–122.

Partial analyses, gage heights, and rates of discharge of water and solids for Pecos River below Penasco River, near Dayton, N. Mex.

[Drainage area, 20,000 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–1907.									
July 20, 24, 25, 27, 28, 29	2	112	114	11,400	748	7.0	14,900	457,000	30,100
July 30, 31, August 1, 2, 3, 4, 5	0	140	352	1,740	2,040	3.8	980	4,600	5,400
September 6, 8, 9, 13, 15, 16	0	131	397	4,120	2,440	2.3	543	6,050	3,580
September 7, 17, 18, 20, 21, 23, 24	4	141	642	2,210	3,380	2.2	553	3,300	5,050
September 26, 29, 30, October 1, 2, 3, 5, 6	0	161	758	442	3,700	1.6	226	269	2,260
October 12, 13, 14, 15, 19, 20	0	163	717	522	3,560	1.7	214	302	2,050
October 22, 23, 25, 29, 30, 31, November 2, 3	0	177	784	214	4,030	1.6	187	107	2,040
November 6, 7, 9, 10, 14, 20, 23	0	188	648	1,200	3,150	2.5	443	1,430	3,770
November 25, 26, 27, 28, 29, 30, December 3	0	152	324	6,890	2,240	3.8	1,250	23,300	7,610
December 4, 6, 10, 13, 15	0	135	225	1,460	1,490	2.9	678	2,670	2,730
December 17, 19, 24, 26, 27, 28, 30	20	171	607	658	2,940	2.7	646	1,150	5,140
January 1, 2, 3, 5, 6	0	224	668	696	3,350	2.6	377	709	3,410
January 13, 14, 15, 16	23	175	640	984	3,070	3.2	625	1,660	5,180
January 23, 24, 25, 26, 27	13	172	546	624	2,760	2.7	401	675	2,990
February 11, 12, 13, 14, 15, 16	0	205	677	804	3,260	2.7	360	781	3,170
February 17, 18, 19, 20, 21, 22	0	131	639	512	3,180	2.6	348	482	3,000
February 25, March 14, 15, 16, 17, 18, 19	10	175	831	314	3,890	2.0	177	150	1,860
March 24, 25, 26, 27, 28, 29, 30, 31	0	164	1,050	156	5,120	1.8	148	62	2,050
April 17, 18, 19, 20	0	144	566	1,710	3,430	3.5	680	3,130	6,300
April 26, 27	0	38	401	2,510	2,530	3.4	560	3,800	3,820
April 29, 30, May 1, 2	0	105	329	1,690	2,340	3.4	589	2,690	3,740
May 6, 7, 8, 9, 10, 11, 12	0	134	339	2,110	2,200	3.1	463	2,640	2,750
May 17, 18, 20	0	32	266	2,770	1,720	3.7	723	5,400	3,350
May 21, 22, 23, 24, 25, 26, 27	0	128	241	2,260	1,720	3.8	864	5,260	4,010
May 28, 29, 30	0	126	287	1,580	1,810	3.5	517	2,200	2,530
June 3, 4, 6, 7, 8, 9	0	112	406	3,760	2,250	3.4	492	5,000	2,990
June 10, 11, 12	0	96	327	1,150	1,940	2.9	282	873	1,480
July 6, 7	0	124	386	4,960	2,350	3.7	705	9,450	4,480
July 8, 9, 10, 11, 12, 13, 14	0	105	257	9,460	2,020	3.8	943	24,100	5,130
July 22, 23, 24, 25, 26, 27	0	42	282	3,660	1,810	2.9	321	3,170	1,570
July 29, 30, 31, August 1, 2, 3, 4	0	62	485	1,180	2,630	2.4	181	576	1,290
August 5, 6, 7, 8, 10, 11	0	37	421	5,600	2,360	3.1	350	5,300	2,240
August 12, 13, 14, 15, 16, 17, 18	0	168	302	8,150	2,020	3.2	421	9,260	2,300
August 19, 20, 21, 22, 23, 24, 25	0	140	623	810	3,100	2.2	147	321	1,230
August 26, 27, 28, 29, 30, 31, September 1	0	114	641	3,220	3,260	2.6	209	1,820	1,840
September 3, 4, 5, 6, 7, 8	0	150	966	414	4,270	1.8	92	103	1,060
September 9, 10, 11, 12, 13, 14, 15	11	122	858	242	4,650	1.7	87	57	1,090
September 16, 17, 18, 19, 20, 21, 22	0	139	772	790	4,470	2.1	134	286	1,620
September 23, 24, 25, 26, 27, 28, 29	9	124	591	702	3,390	2.2	137	260	1,250
September 30, October 1, 2, 3, 4, 5, 6	0	144	617	648	3,610	2.3	155	271	1,510
October 7, 8, 9, 10, 12, 13	0	157	644	620	3,720	2.4	175	293	1,760
October 14, 15, 16, 17, 18, 19, 20	9	142	571	720	3,380	2.6	219	426	2,000
October 21, 22, 23, 24, 25, 26, 27	0	189	562	606	3,200	2.5	192	312	1,660
October 28, 29, 30, 31, November 1, 3	0	166	584	280	3,430	2.6	206	156	1,910
November 4, 5, 6, 7, 8, 9, 10	9	162	626	838	3,210	3.0	220	498	1,850
November 11, 14, 15, 16, 17	8	173	542	642	2,740	2.9	295	511	2,190
November 18, 20, 21, 22, 23, 24	9	208	704	908	3,050	3.4	454	1,110	3,740
November 26, 27, 28, 29, 30	0	177	1,090	2,110	4,240	3.8	656	3,740	7,500
December 2, 3, 4, 5, 6, 7, 8	0	169	971	2,940	3,910	4.0	807	6,400	8,530
December 9, 10, 11, 12, 13, 14, 15	0	175	492	2,380	2,750	4.0	742	4,760	5,510
December 16, 17, 18, 19, 20, 21, 22	0	194	533	1,310	2,560	3.5	511	1,800	3,540
December 23, 24, 25, 26, 27, 28, 29	0	207	586	1,790	2,890	3.1	367	1,770	2,870
December 30, 31, January 1, 2, 3, 4, 5	0	208	622	904	3,080	3.2	385	940	3,200
January 6, 7, 8, 10, 11, 12	7	181	626	858	3,060	3.3	450	1,040	3,720
January 13, 14, 15, 16, 17, 18	0	191	660	886	3,150	3.4	475	1,140	4,030
January 20, 21, 22, 23, 24, 25, 26	0	186	552	944	2,850	3.5	542	1,380	4,170
January 27, 28, 29, 30, 31, February 1, 2	0	194	562	776	2,960	3.3	419	878	3,340
February 3, 4, 5, 6, 7, 8, 9	9	179	565	720	2,860	3.1	381	741	2,950
February 10, 11, 12, 13, 14, 15, 16	5	191	570	1,240	2,900	3.3	476	1,600	3,730
February 24, 25, 26, 27, 28, March 1, 2	0	176	752	290	3,660	2.7	226	177	2,240
March 3, 4, 5, 6, 7, 9	9	153	872	322	3,960	2.4	155	135	1,660
March 10, 11, 12, 13, 14, 15, 16	5	572	985	44	4,720	2.2	118	14	1,510
March 17, 18, 19, 20, 21, 22, 23	9	153	949	126	4,570	2.2	123	42	1,520
March 24, 25, 26, 27, 28, 29, 30	0	157	1,110	420	4,890	2.2	122	138	1,610
March 31, April 1, 2, 3, 4, 5, 6	9	143	748	1,200	3,710	2.8	246	800	2,470
April 7, 8, 9, 10, 11, 12, 13	5	138	794	172	4,170	2.4	155	72	1,750
April 14, 15, 16, 17, 18, 19, 20	14	131	964	532	4,470	2.3	135	194	1,630

Relative amount of substances in solution in water from Pecos River below Penasco River, near Dayton, N. Mex.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium (Na+$\frac{3}{4}$K).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905–1907.											
July 20–September 24	26	.....	2,540	.....	2.7	[a] 10	0.00	5.8	41	16	0.005
September 26–November 23	29	+0.6	3,450	13	3.5	14	.00	5.1	40	22	.000
November 25–January 6	25	.....	2,360	14	3.3	.....	.00	7.0	43	18	.002
January 13–February 22	22	+1.8	3,120	13	3.3	13	.00	6.0	39	19	.001
February 25–April 20	26	.....	3,910	14	.....	18	.00	4.0	.....	23	.000
April 26–May 20	16	+ .2	1,820	15	3.2	11	.00	5.8	44	16	.000
May 21–June 12	19	+3.4	1,920	17	2.8	12	.00	6.0	42	18	.002
July 6–August 4	22	+2.6	2,080	16	2.8	12	.00	4.4	44	17	.000
August 5–September 8	27	.....	2,940	.....	3.1	14	.00	5.3	40	20	.000
August 26–September 29	28	+3.5	3,820	14	3.2	14	.00	3.9	40	20	.000
September 30–October 27	27	+3.8	3,650	14	3.1	13	.00	4.5	39	18	Trace.
October 2–November 24	24	+3.4	3,260	14	3.5	14	.00	6.0	38	21	.000
November 26–December 22	26	+2.9	3,470	12	3.4	16	.00	4.5	37	23	.026
December 23–January 18	26	+2.6	3,080	13	3.5	15	.00	6.7	39	21	.006
January 20–February 16	28	+2.4	2,960	14	3.6	13	.32	6.0	40	20	.000
February 24–March 23	26	+2.1	4,070	13	3.2	14	.00	3.9	39	21	.000
March 24–April 20	28	+2.4	4,430	15	3.3	12	.00	6.9	39	20	.....
Mean	.....	2.4	3,110	14	3.2	13	.02	5.4	40	20	.002

[a] Sodium is 98 per cent and potassium is 3.5 per cent of this amount.

Monthly discharge, in second-feet, of Pecos River near Dayton, N. Mex.

Month.	1906.	1907.	1908.	Mean.
January	439	469	373	427
February	342	395	277	338
March	194	139	79	137
April	530	210	109	283
May	626	352	138	372
June	308	562	92	321
July	643	464	478	528
August	270	335	1,560	722
September	117	271	271	220
October	190	446	45	227
November	391	419	155	322
December	599	425	362	462
Mean	387	374	328	363

PECOS RIVER NEAR SANTA ROSA, N. MEX.

Samples of water were collected from Pecos River at a railroad bridge near Santa Rosa, N. Mex., between July 7, 1905, to December 29, 1906. A gaging station was established at the bridge by the United States Geological Survey May 5, 1903, and discontinued December 31, 1906. Stream-flow data, including gage heights and estimates of discharge, for the gaging station have been published by the Survey in the following reports:

Water-Supply Papers: 99, pp. 363–365; 132, pp. 97–98; 174, pp. 93–94; 210, pp. 78–79.

Partial analyses, gage heights, and rates of discharge of water and solids for Pecos River at railroad bridge near Santa Rosa, N. Mex.

[Drainage area 2,900 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905-6.									
July 7				282	1,660	0.8	14	11	63
October 6, 7, 8, 9, 10, 17, 18	10	148	60	0	1,900	0.8	14	0	72
October 19, 20, 21, 22, 23	0	215	49	212	2,010	0.8	14	8	76
October 25, 26, 27, 28	6	143	51	38	2,110	0.8	14	1	80
October 29, 31, November 1, 3, 4	0	148	50	20	1,960	0.8	14	1	74
November 5, 6, 7, 8, 9, 10, 11	2	131	42	576	1,610	0.9	26	40	113
November 12, 13, 14, 15, 18	0	161	44	94	1,880	0.9	12	3	61
November 20, 21, 22, 23, 24	0	148	39	5,910	1,380	1.8	667	10,600	2,490
November 26, 27, 28, 29, 30, December 1, 2	0	132	18	3,090	526	1.7	300	2,500	426
December 4, 5, 6, 7, 8, 9	0	154	32	452	702	0.8	16	20	30
December 10, 11, 12, 13, 14, 15	0	165	32	298	1,170	0.8	12	10	38
December 17, 19, 20, 22, 23	0	175	58	270	1,800	0.5	12	9	58
December 24, 25, 26, 28, 30	0	176	49	164	1,970	0.6	14	6	75
December 31, January 1, 2, 3, 4, 5, 6	0	144	46	124	1,880	0.6	14	5	71
January 7, 8, 9, 10, 11, 12, 13	0	168	51	10	1,850	0.6	14	0	70
January 14, 15, 16, 17, 18, 19, 20	0	158	51	208	1,920	0.6	14	8	73
January 21, 22, 24, 25, 26, 27	0	135	58	164	2,170	0.6	14	6	82
January 28, 29, 30, 31, February 1, 2, 3	0	152	65	30	2,050	0.6	14	1	78
February 3, 4, 6, 7, 9	0	165	63	372	2,150	0.6	13	13	76
February 12, 13, 14, 15, 16, 17	0	133	54	98	1,990	0.6	14	4	75
February 18, 19, 20, 21, 23, 24	0	103	74	308	2,090	0.6	14	12	79
February 25, 26, 27, 28, March 1, 2, 3	0	146	70	250	2,320	0.5	12	8	75
March 5, 6, 7, 8, 9	6	138	61	102	2,250	0.5	10	3	61
March 10, 11, 15, 16, 17	0	114	68	222	2,070	0.5	10	6	56
March 19, 20, 21, 22, 23, 24	0	102	72	190	2,120	0.5	10	5	57
March 26, 27, 30, 31	0	148	47	514	1,370	0.8	48	67	177
April 1, 3, 5, 6, 7	0	140	19	2,090	546	1.7	273	1,540	403
April 9, 10, 11, 12, 13, 14	0	82	37	1,920	368	1.8	308	1,600	306
April 15, 16, 17, 20	0	73	5	1,360	252	1.8	336	1,230	229
April 22, 23, 24, 25, 27	0	96	10	1,730	250	2.0	508	2,380	343
April 30, May 1, 2, 3	13	19	5	720	204	1.9	442	859	243
May 8, 9, 10, 11, 12	0	96	5	1,260	220	2.3	664	2,270	395
May 14, 15, 17, 18	6	147	2	1,080	178	2.2	642	1,880	309
May 22, 25, 26	0	179	3	718	174	2.0	479	930	225
May 27, 28, 29, 30, 31, June 1, 2	0	96	5	384	216	2.0	423	439	247
June 4, 6, 7, 8, 9	0	74	10	3,130	240	2.0	442	3,740	286
June 13, 15	0	83	10	3,600	314	3.2	1,480	54,400	1,260
June 17, 19, 21, 22, 23	0	105	15	8,060	444	1.6	300	6,530	360
June 25, 26, 27, 29, 30	0	134	25	226	978	0.9	35	21	92
July 2, 3, 4, 5, 6, 7	0	128	20	6,840	582	1.4	268	4,950	422
July 11, 12	0	112	20	13,300	242	1.5	970	32,200	634
July 15, 16, 17, 18, 19, 20, 21	0	89	10	9,900	300	1.9	534	14,300	433
July 22, 23, 24, 25, 26, 27, 28	0	57	20	7,610	450	1.5	273	5,620	332
July 30, 31, August 1, 2, 3, 4	0	255	10	8,840	532	1.7	334	7,970	480
August 5, 6, 7, 8, 9, 10, 11	0	49	15	9,270	290	2.0	500	12,500	392
August 12, 13, 14, 15, 16, 17, 18	0	144	25	2,090	894	1.2	65	366	157
August 19, 20, 21, 22, 23, 24, 25	0	167	44	348	1,560	0.9	14	13	59
August 26, 27, 28, 29, 30, 31, September 1	0	141	33	154	1,590	0.9	17	7	73
September 2, 3, 4, 5, 6, 7, 8	0	71	20	890	1,320	1.0	30	72	107
September 9, 10, 11, 12, 13, 14, 15	0	144	40	190	1,680	0.9	13	7	59
September 16, 17, 18, 19, 20, 21, 22	0	141	51	12	1,890	0.9	14	0	72
September 23, 24, 25, 26, 27, 28, 29	8	119	45	976	1,610	1.0	29	76	126
September 30, October 1, 2, 3, 4, 5, 6	0	71	23	1,990	924	1.1	53	285	132
October 7, 8, 9, 10, 11, 12, 13	14	107	26	1,480	860	1.3	83	332	193
October 14, 15, 16, 17, 18, 19, 20	9	150	33	116	1,310	1.1	32	10	113
October 21, 22, 23, 24, 25, 26, 27	0	150	31	218	1,470	0.9	22	13	88
October 28, 29, 30, 31, November 1, 2, 3	0	156	24	274	1,290	1.1	37	27	129
November 4, 5, 6, 7, 8, 9, 10	0	154	21	138	1,060	1.2	67	25	192
November 11, 12, 13, 14, 15, 16, 17	0	163	36	68	1,440	1.1	45	8	175
November 18, 19, 20, 21, 22, 23, 24	0	158	44	282	1,670	1.1	42	32	190
November 25, 26, 27, 28, 29, 30, December 1	3	150	37	232	1,310	1.3	78	49	276
December 1, 2, 3, 4, 5, 7, 8	0	165	37	3,140	546	1.6	226	1,920	333
December 9, 10, 11, 12, 13, 14, 15	0	125	15	926	384	1.5	184	460	191
December 16, 17, 18, 19, 20, 21, 22	0	157	37	110	1,170	1.0	39	12	123
December 23, 24, 25, 26, 27, 28, 29	0	163	30	218	1,070	0.9	15	9	43

Relative amount of substances in solution in water from Pecos River at railroad bridge near Santa Rosa, N. Mex.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905–6.											
October 6–November 4	21	.....	1,930	.....	2.9	2.3	0.00	8.0	60	2.8	0.002
November 5–December 2	24	+0.5	1,300	22	3.0	[a]2.6	.00	9.1	58	1.9	.010
December 4–30	22	.0	1,380	22	2.7	3.8	.00	12	59	2.9	.013
December 31–January 4	27	.....	1,980	22	2.7	.....	.00	7.3	.....	4.3	.002
January 28–February 24	24	+2.2	2,040	19	4.4	3.9	.00	5.2	59	3.3	.000
February 25–March 24	23	.....	2,440	.....	2.6	4.3	.00	5.2	.....	3.0	.000
March 26–April 20	19	+3.6	640	23	3.3	3.9	.00	19	52	3.6	.006
April 22–May 18	18	.....	246	23	3.2	6.5	.....	.....	33	.....	.....
May 22–June 15	17	+8.6	250	27	3.2	5.2	.00	46	32	4.4	.022
June 17–July 12	18	+ .5	671	23	2.7	3.6	.00	24	49	4.5	.000
July 15–August 4	26	−2.3	714	21	2.8	3.6	.00	22	45	8.3	.000
August 5–September 1	28	+2.9	1,050	22	2.9	3.8	.00	15	54	2.9	.000
September 2–29	28	.....	1,590	.....	2.9	2.8	.00	9.7	57	2.6	.003
September 30–October 27	28	+1.4	1,200	22	2.7	2.9	.00	14	53	2.8	Trace.
October 28–November 24	28	.....	1,370	.....	2.8	2.6	.00	11	55	2.4	.000
November 25–December 22	28	+1.9	860	23	3.0	3.7	.00	17	53	3.6	.10
December 23–29	7	.....	1,060	23	3.0	.....	.00	14	52	2.9	.21
Mean	.....	2.4	1,220	22	3.0	3.7	.00	15	51	3.5	.023

[a] Sodium is 98 per cent and potassium is 3.0 per cent of this amount.

Monthly discharge, in second-feet, of Pecos River near Santa Rosa, N. Mex.

Month.	1906.	Month.	1906.
January	14	August	179
February	13	September	22
March	15	October	44
April	374	November	54
May	544	December	132
June	399		
July	377	Mean	181

PIT RIVER NEAR BIEBER, CAL.

Samples of water were collected from Pit River at Muck Valley, near Bieber, Cal., from July 7, 1905, to March 2, 1907. A gaging station was established by the United States Geological Survey at Muck Valley January 22, 1904, and was discontinued October 1, 1908. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for the gaging station have been published by the Survey in the following reports:

Water-Supply Papers: 134, pp. 134–137; 177, pp. 136–139; 213, pp. 104–105; 251, pp. 160–162.

Partial analyses, gage heights, and rates of discharge of water and solids for Pit River at Muck Valley, near Bieber, Cal.

[Drainage area, 2,950 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–1907.									
July 7				90	164	2.3	44	11	19
July 7, 8, 9, 10, 11, 12, 13, 14, 15	0	161	20	122	226	2.4	56	18	34
July 19				66	192	2.4	53	9	27
July 16, 17, 18, 19, 20, 21, 22	4	160		62	266	2.4	59	10	42
July 23, August 4, 5, 6, 7, 8, 9	0	174	14	46	204	1.8	17	2	9
August 9				30	278	1.8	16	1	12
August 10, 11, 18, 20, 21, 22, 23	0	174	16	34	226	1.7	9	1	5
August 18				24	290	1.8	14	1	11
August 24, 25, 26, 27, 28, 29, 30	18	130	7	32	224	1.6	5	0	3
August 29				16	240	1.7	10	0	6
August 31, September 1, 2, 3, 6, 7, 8	15	142	21	22	174	1.5	2	0	1
September 10, 11, 12, 13, 20, 28, 29	22	136	14	36	218	1.4	1	0	1
September 20				36	198	1.4	1	0	1
October 7, 17, 18, 19, 20, 21	13	199	21	26	292	1.9	17	1	13
October 22, 23, 26, 27, November 8	0	185	22	74	232	2.2	39	8	25
December 21, 22, 24, 25, 26, 27, 28, 30	0	147	13	104	224	2.5	80	22	48
December 31, January 15, February 7	0	111	14	74	170	3.4	386	77	177
February 11, 12, 13, 14, 15, 16, 17	0	69	28	260	116	5.4	1,600	1,120	501
February 18, 19, 20, 21, 22, 23	0	70	7	134	136	6.6	2,980	1,080	1,090
March 1, 12, 13, 21, 22, 23	0	67	19	188	138	7.5	4,390	2,230	1,640
April 29, 30, May 1, 2, 4, 5	0	89	5	30	176	5.0	1,160	94	551
May 7, 8, 9, 10, 11, 12	0	92	5	44	156	4.7	900	107	379
May 14, 15, 16, 17, 18, 19	0	89	10	56	146	4.8	1,020	154	402
May 20–26	0	89	43	20	190	4.7	924	50	475
May 27, 28, 29, 30, 31, June 1, 2	0	96	14	30	164	4.6	805	65	357
June 3, 4, 5, 6, 7, 8, 9	0	191	5	24	186	4.4	710	46	356
June 10, 11, 12, 13, 14, 15, 16	0	191	10	64	166	4.2	569	98	255
June 17, 18, 19, 20, 21, 22, 23	0	105	10	24	170	3.7	328	21	151
June 24, 25, 26, 27, 28, 29, 30	0	109	5	40	174	4.1	508	55	239
July 1, 2, 3, 5, 6, 7	18	70	7	30	156	3.9	412	33	174
July 8, 9, 10, 11, 12, 13, 14	0	108	5	16	164	3.7	322	14	143
July 15, 16, 17, 18, 19, 20	0	105	10	10	180	3.4	212	6	103
August 1, 2, 3, 4	0	124	10	70	156	2.6	76	14	32
August 5, 6, 7, 8, 9, 10, 11	0	122	9	50	122	2.5	63	9	21
August 12, 14, 16, 17, 18	0	115	6	538	148	2.5	66	96	26
August 19, 20	0	112	28	622	204	2.2	41	69	23
August 27, 28, 29, 30, 31, September 1	0	136	8	72	198	1.8	21	4	11
September 2, 3, 4, 5, 6, 7, 8	0	139	9	112	158	1.8	21	6	9
September 15, 16, 17, 18, 19, 20, 21, 22	0	158	14	28	216	1.9	26	2	15
September 26, 27, 28, 29	0	150	12	78	164	1.9	24	5	11
September 30, October 1, 2, 4, 6	0	150	11	72	186	1.9	23	4	12
October 8, 9, 10, 11, 12, 13	0	145	9	78	198	2.0	27	6	14
January 1, 2, 3, 4, 5, 6, 7, 8, 9	0	113	10	8	200	4.5	754	16	407
January 10, 11, 12, 13, 14, 15, 16, 17, 18, 19	0	122	10	0	200	3.7	322	0	174
January 20, 21, 22, 23, 24, 25, 26	0	122	15	16	180	3.6	279	12	136
January 27, 28, 29, 30, 31, February 1, 2	0	67	8	20	262	6.5	3,240	175	2,290
February 3, 4, 5, 6, 7, 8, 9	0	50	5	170	142	9.5	8,680	3,990	3,330
February 10, 11, 12, 13, 14, 15, 16	0	67	16	80	140	6.1	2,280	492	862
February 17, 18, 20, 21, 22, 23	0	76	16	50	140	5.9	2,010	272	706
February 24, 25, 26, 27, March 1, 2	0	72	5	78	114	6.4	2,660	560	819

Relative amount of substances in solution in water from Pit River at Muck Valley, near Bieber, Cal.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{4}{7}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905–1907.											
July 7–August 23	30	+3.3	240	13	5.0	[a] 19	0.00	77	8.7	11	0.13
August 24–October 21	26	− .4	230	13	4.8	22	.00	83	8.7	16	.12
October 22–February 11	23	− .1	191	11	4.0	19	.00	66	13	14	.23
February 18–March 23	12	.....	143	.....	4.4	18	.00	.....	15	6.7	.19
April 29–May 26	25	+8.9	180	13	5.6	13	.00	55	17	4.9	.05
May 27–June 23	28	+1.8	170	15	4.9	12	.00	65	8.8	13	.05
June 24–July 20	26	+3.2	160	14	4.8	15	.00	79	6.1	7.5	.01
August 1–18	16	.....	195	9.7	6.1	20	.00	.....	9.2	5.0	.23
August 27–September 29	25	.....	206	.....	5.8	18	.00	72	10	5.8	.17
September 30–October 13	11	+9.3	230	12	4.8	16	.00	62	10	6.5	.10
January 1–February 2	33	.....	180	13	4.5	19	.00	.....	8.9	7.2	.49
February 3–March 2	26	.....	172	13	3.8	12	.00	.....	8.7	4.5	.52
Mean	.....	3.9	191	13	4.9	17	.00	70	10	8.5	.19

[a] Sodium is 95 per cent and potassium is 6.7 per cent of this amount.

Monthly discharge, in second-feet, of Pit River near Bieber, Cal.

Month.	1904.	1905.	1906.	1907.	1908.	Mean.
January	[a] 238	1,040	[b] 2,150	710	861	1,000
February	3,950	1,080	1,930	4,190	339	2,300
March	7,590	1,100	4,640	6,940	322	4,120
April	4,210	950	2,590	2,970	78	2,160
May	3,440	166	948	1,130	83	1,150
June	542	103	544	2,160	86	687
July	83	52	[a] 311	323	68	167
August	33	10	[a] 51	72	9	350
September	16	1	[a] 24	52	5	20
October	103	15	[c] 25	113	.....	66
November	165	76	.....	307	.....	183
December	304	[a] 64	.....	799	.....	389
The year	1,720	382	.....	1,650	.....	1,050

[a] Approximate. [b] January 15–31. [c] October 1–13.

PUTA CREEK NEAR WINTERS, CAL.

Samples of water were collected from Puta Creek at a railroad bridge near Winters, Cal., from September 14, 1905, to March 1, 1907. A gaging station was established by the United States Geological Survey near Winters, Cal., September 26, 1905. Stream-flow data, including gage heights and estimates of discharge, for the station have been published by the Survey in the following reports:

Water-Supply Papers: 177, pp. 182–183; 213, pp. 116–117; 251, pp. 184–187.

Partial analyses, gage heights, and rates of discharge of water and solids for Puta Creek at railroad bridge near Winters, Cal.

[Drainage area, 805 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–1907.									
September 14	.....	.....	.....	98	366	.....	.....	.....	.....
September 26	.....	.....	.....	90	400	.....	.....	.....	.....
January 2, 3, 4, 5, 6	0	344	18	108	380	4.6	23	7	24
January 7, 8, 9, 10, 11, 12, 13	27	254	14	272	266	5.5	716	525	514
January 14, 15, 16, 17, 18, 19, 20	0	86	11	1,160	122	16.5	11,600	36,300	3,820
January 21, 22, 23, 24, 25, 26, 27	0	178	14	94	240	6.8	1,150	292	745
January 29, 30, 31, February 1, 2, 3	13	214	22	38	272	5.3	369	38	271
February 4, 5, 6	0	257	18	74	268	4.9	190	38	138
February 13, 14, 15, 16, 17	0	185	14	330	206	7.2	1,870	1,670	1,040
February 18, 19, 20, 21, 22, 23, 24	0	147	26	294	178	8.2	2,650	2,100	1,270
February 26, 27, 28, March 1, 2, 3	0	195	42	142	244	7.5	1,950	746	1,280
March 4, 5, 6, 7, 9	25	127	14	138	230	7.6	2,020	753	1,250
March 11, 12, 13, 14, 15, 16, 17	0	170	19	430	252	8.2	2,490	2,890	1,690
March 18, 19, 20, 21, 22, 23, 24	7	167	19	210	244	9.3	3,540	2,010	2,330
March 25, 26, 27, 28, 29, 30, 31	0	160	24	570	226	10.5	4,770	7,350	2,910
April 1, 2, 3, 4, 5, 6, 7	0	230	19	68	294	8.1	2,310	424	1,830
April 8, 10, 11, 12, 13	54	188	22	98	300	6.8	1,090	288	883
April 15, 16, 17, 18, 19, 20, 21	0	304	14	0	410	6.4	721	0	799
April 22, 23, 24, 25, 26, 27	6	310	19	30	378	6.2	613	50	626
May 3, 4, 5, 6, 7	38	281	19	0	380	6.0	384	0	394
May 8, 9, 10, 11, 12	63	192	14	0	404	5.8	305	0	333
May 14, 15, 16, 17, 18, 19, 20	25	278	19	24	426	5.8	276	18	318
May 21, 22, 23, 24, 25, 26	0	326	24	8	402	5.8	328	7	356
May 27, 28, 29, 30, 31, June 1, 2	17	190	16	42	258	6.3	706	80	492
June 3, 4, 5, 6, 7, 8	32	201	14	0	330	5.8	371	0	330
June 10, 12, 13, 14, 15, 16	25	223	20	22	334	5.6	271	16	244
June 17, 18, 19, 20, 21, 22, 23	26	239	15	24	340	5.3	224	15	206
June 24, 25, 26, 27, 28, 29, 30	19	268	20	6	354	5.1	171	3	163
July 2, 3, 4, 7	9	300	20	48	368	4.8	118	15	117
July 8, 9, 10, 11, 12, 13, 14	48	210	20	54	350	4.6	89	13	84
July 15, 17, 18, 19, 20, 21	70	169	.....	66	366	4.6	63	11	62
July 22, 23, 24, 25, 26, 27, 28	38	246	25	16	386	4.7	38	2	40
July 30, August 1, 2, 3, 4	61	196	30	38	398	4.7	29	3	31
August 5, 6, 7, 8, 9, 11	0	317	25	6	378	4.8	26	0	27
August 12, 13, 14, 15, 16, 17, 18	16	304	30	72	364	4.8	20	4	20
August 21, 22, 23, 24, 25	17	309	24	32	398	4.7	16	1	17
August 26, 27, 28, 30, 31, September 1	0	356	29	12	416	4.7	17	1	19
September 2, 3, 4, 5, 6, 7, 8	0	343	38	78	364	4.7	18	4	18
September 9, 10, 11, 12, 14, 15	35	264	24	38	344	4.7	14	1	13
September 16, 17, 18, 19, 20, 21	0	347	22	68	364	4.7	13	2	13
September 23, 24, 25, 26, 27, 29	17	304	27	26	418	4.7	14	1	16
September 30, October 1, 2, 4, 5	8	320	22	20	394	4.7	12	1	13
October 7, 8, 9, 11, 12	8	313	25	54	376	4.7	12	2	12
October 14, 15, 16, 17, 18	0	340	22	20	402	4.7	15	1	16
October 21, 22, 23, 24, 25, 26	0	346	26	4	404	4.7	13	0	14
October 28, 29, 30, November 2, 3	0	340	31	22	372	4.7	17	1	17
November 4, 5, 6, 7, 8, 9, 10	17	307	30	16	406	4.9	42	2	46
November 11, 12, 13, 14, 15, 17	6	324	29	26	354	4.9	34	2	33
November 18, 19, 20, 21, 22, 24	13	313	28	54	348	4.8	31	5	29
November 25, 26, 27, 28, 29, 30, December 1	20	298	30	30	330	4.9	37	3	33
December 2, 3, 5, 6, 8	0	340	31	10	376	4.9	45	1	46
December 9, 10, 11, 12, 13, 14, 15	0	196	25	.....	.....	6.5	1,070	.....	.....
December 16, 17, 18, 19, 20, 22	0	226	17	44	234	5.5	200	24	126
December 23, 25, 26, 27, 28, 29	0	158	15	216	236	7.9	2,520	1,470	1,610
December 30, 31, January 1, 2, 3, 4, 5	0	178	14	144	236	7.5	1,600	622	1,020
January 7, 8, 9, 10, 11, 12	0	108	24	872	168	10.4	4,400	7,340	1,990
January 14, 15, 16, 17, 18, 19	0	151	14	156	192	7.6	1,470	619	762
January 22, 23, 24	0	188	13	34	206	6.8	872	80	485
January 27, 28, 29, 30, 31, February 1, 2	0	108	13	430	152	10.3	5,330	6,180	2,190
February 3, 4, 5, 6, 7, 8, 9	0	162	13	110	198	8.7	2,490	740	1,330
February 10, 11, 12, 13, 14, 15, 16	14	196	16	32	292	6.7	821	71	646
February 17, 18, 19, 20, 21, 23	0	241	21	30	294	6.4	598	48	475
February 24, 25, 26, 27, 28, March 1	5	222	16	20	264	6.4	623	34	444

Relative amount of substances in solution in water from Puta Creek at railroad bridge near Winters, Cal.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1906–7.											
January 2–27	26	.....	236	10	15	.....	0.00	91	8.9	9.3	0.15
January 29–February 24	25	− 2.3	240	12	13	9.6	.00	81	22	13	.22
February 26–March 24	25	− 4.4	210	10	13	7.8	.00	86	12	15	.02
March 25–April 21	26	+ 7.8	263	11	15	11	.00	89	14	7.2	.03
April 22–May 20	23	+ 5.2	358	8.1	14	11	8.7	70	12	5.6	.00
May 21–June 16	25	+ 4.0	318	11	15	7.9	16	58	13	8.8	.07
June 17–July 14	25	− 2.6	371	8.9	13	8.6	16	66	8.9	8.1	.01
July 15–August 11	23	+ 6.5	362	8.6	14	11	1.8	81	11	5.5	.00
August 12–September 8	25	+ 5.1	394	9.6	13	10	3.3	80	10	7.6	.00
September 9–October 5	23	.....	421	11	13	10	2.8	.....	10	6.9	T.
October 7–November 13	21	+ 3.3	390	10	13	10	1.6	81	12	8.7	T.
November 4–December 1	26	+ 5.2	392	11	13	10	.00	86	12	7.9	.00
December 2–29	24	+ 7.9	306	9.8	12	10	.00	74	11	8.5	.07
December 30–February 2	29	+ 6.2	216	12	11	9.3	.00	70	13	9.3	.10
February 3–March 1	26	.....	280	11	14	9.7	.00	.....	14	6.4	T.
Mean	.....	5.0	317	10	13	10	3.3	78	12	8.5	.04

Monthly discharge, in second-feet, of Puta Creek near Winters, Cal.

Month.	1905.	1906.	1907.	1908.	Mean.
January	.....	3,100	2,320	810	2,080
February	.....	1,330	1,860	1,390	1,530
March	.....	3,060	5,150	662	2,960
April	.....	1,130	919	130	726
May	.....	411	230	65	235
June	.....	266	110	28	135
July	.....	72	40	7	40
August	.....	21	16	5	14
September	[a] 10	15	15	4	11
October	10	14	18	4	12
November	13	34	25	7	20
December	21	836	198	138	298
The year	.....	857	908	271	672

[a] September 26–30.

REDWATER RIVER NEAR BELLE FOURCHE, S. DAK.

Samples of water were collected from Redwater River at a county bridge near Belle Fourche, S. Dak., from April 9, 1905, to June 23, 1906. A gaging station was established near Belle Fourche by the United States Geological Survey July 20, 1903, and was discontinued June 23, 1906. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for the station have been published by the Survey in the following reports:

Water-Supply Papers: 99, pp. 59–60; 130, pp. 172–175; 172, pp. 160–161; 208, pp. 131–132.

Partial analyses, gage heights, and rates of discharge of water and solids for Redwater River at county bridge near Belle Fourche, S. Dak.

[Drainage area, 1,020 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–6.									
April 9, 10, 11	20	181	10	54	912	3.0	210	31	517
April 16, 17, 18, 19, 20, 22	10	247	4	70	880	2.9	190	36	452
April 23, 24, 25, 27, 28, 29	0	293	6	16	852	2.9	182	8	419
April 30, May 1, 2, 3, 4, 5, 6	0	205	6	374	758	3.4	378	382	784
May 7, 8, 9, 11, 12, 13	15	167	7	662	560	4.1	723	1,290	1,090
May 14, 15, 16, 18, 19, 20	18	176	30	248	560	3.9	591	396	894
May 21, 22, 23, 24, 25, 26, 27	12	195	15	990	626	3.7	522	1,400	882
May 28, 29, 30, 31, June 1, 2, 3	18	207	12	168	754	3.3	325	148	662
June 4, 6, 7, 8, 9, 10	20	197	5	58	884	2.9	182	29	434
June 11, 13, 14, 15, 16, 17	12	194	7	78	856	3.0	205	43	474
June 19, 20, 21, 22, 23, 24	0	244	14	296	784	3.4	378	302	800
June 25, 26, 27, 28, 29, 30	0	235	28	90	778	3.1	251	61	528
July 2, 3, 4, 5, 6, 7, 8	0	191	16	848	608	4.1	748	1,710	1,230
July 9, 10, 11, 12, 13, 14, 15	0	224	13	258	678	3.7	512	357	936
July 16, 17, 18, 20, 21	12	209	16	96	748	3.4	386	100	780
July 23, 24, 25, 26, 27, 28, 29	12	186	9	310	726	3.6	458	383	897
July 30, 31, August 1, 2, 3, 4	2	232	11	312	750	3.5	401	338	813
August 6, 7, 8, 9, 10, 11, 12	0	223	12	76	830	3.2	267	55	598
August 13, 14, 16, 17, 18, 19	0	220	10	296	854	3.2	284	227	655
August 20, 21, 23, 24, 26	8	200	6	0	934	2.9	198	0	500
August 28, 29, 30, September 1, 2	0	212	22	64	914	2.7	128	22	316
September 3, 4, 5, 6, 7, 8, 9	0	230	21	36	940	2.9	174	17	442
September 10, 11, 12, 15, 20, 21, 22, 23	0	223	18	36	844	2.9	180	18	410
September 24, 25, 26, 27, 28, 29, October 3	0	218	10	66	874	2.9	172	31	406
October 4, 5, 6, 7, 8, 10, 11	0	232	9	10	850	3.0	194	5	446
October 12, 13, 14, 15, 16, 17, 18, 19	27	193	11	0	904	3.1	268	0	655
October 21, 22, 23, 24, 25	3	240	10	50	824	3.5	410	55	912
October 31–November 1, 2, 3, 4	0	254	8	22	996	3.5	410	24	1,100
November 6, 7, 8, 9, 10, 11	12	223	15	0	824	3.6	456	0	1,010
November 12, 13, 14, 15, 16, 17	0	250	10	42	926	3.6	446	51	1,120
November 24, 25	0	.....	11	108	662	3.6	457	133	816
April 1, 2, 4, 5, 6, 7	0	249	19	110	874	2.4	227	68	536
April 8, 9, 10, 12, 13, 14	0	246	5	150	820	2.4	220	89	487
April 15, 18, 19,	0	246	5	132	950	2.4	220	78	565
May 16, 17, 18, 19	0	217	5	370	860	2.6	265	265	615
May 21, 22, 23, 24, 25, 26	0	217	5	458	844	3.1	404	500	922
May 27, 28, 29, 30, 31, June 1, 2	0	214	10	630	720	3.1	403	686	784
June 3, 4, 5, 6, 7, 8, 9	0	220	5	312	832	2.9	330	278	741
June 11, 12, 13, 14, 16	10	201	5	114	862	2.6	261	80	607
June 17, 18, 19, 20, 21, 22, 23	10	207	5	1,280	874	2.6	258	890	607

Relative amount of substances in solution in water from Redwater River at railroad bridge near Belle Fourche, S. Dak.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905–6.											
April 9–May 13	22	.....	780	.....	4.7	3.2	1.2	26	45	0.82	0.03
May 14–June 10	26	+1.3	694	20	5.2	3.0	.88	31	45	2.2	.00
June 11–July 8	25	.....	746	.....	5.0	2.8	1.3	27	46	1.0	.05
July 9–August 5	26	.....	729	.....	.....	[a] 3.2	.00	31	43	2.9	.03
August 6–September 2	23	+ .8	844	20	5.4	2.4	.00	25	51	1.2	.03
September 3–October 11	28	− .5	898	20	5.2	1.9	.00	22	50	4.7	.03
October 12–November 11	24	+ .7	774	21	5.8	1.9	.00	30	52	1.3	.00
November 12–25	8	+ .1	662	19	6.8	2.0	.00	19	58	2.9	.02
April 1–May 19	19	.....	672	20	6.3	3.0	.....	.....	59	.....	.....
May 21–June 16	25	−2.9	704	19	6.1	3.1	.00	31	50	5.4	.01
June 17–23	7	.....	849	18	5.2	4.2	.00	22	.....	.93	.00
Mean	.....	1.0	759	20	5.6	2.8	.34	26	50	2.3	.02

[a] Sodium is 86 per cent and potassium is 18 per cent of this amount.

Monthly discharge, in second-feet, of Redwater River near Belle Fourche, S. Dak.

Month.	1903.	1904.	1905.	1906.	Mean.
January	.....	.....	.....	.....	[a] 200
February	.....	.....	.....	.....	[a] 200
March	.....	[a] 213	171	[b] 611	[a] 250
April	.....	222	192	219	211
May	.....	144	554	333	344
June	.....	1,100	256	[a] 281	546
July	[c] 91	177	520	.....	263
August	162	92	247	.....	167
September	291	180	170	.....	214
October	123	212	296	.....	212
November	.....	195	445	.....	320
December	.....	218	.....	.....	218
Mean	.....	.....	.....	.....	[a] 262

[a] Approximate. [b] March 26–31. [c] July 21–31.

RIO GRANDE NEAR EL PASO, TEX.

Samples of water were collected from Rio Grande at Courchesne, near El Paso, Tex., from June 8, 1905, to April 30, 1907. A gaging station was established May 1, 1897, by the United States Geological Survey at Courchesne, 1 mile above the old station. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for the station have been published by the Survey in the following reports: [a]

Annual Reports: 11, II, pp. 54, 57, 99; 12, II, pp. 280, 350, 360; 13, III, pp. 94, 99; 14, IV, 114–115; 18, IV, pp. 257–259; 19, IV, pp. 389–390; 20, IV, pp. 58, 358, 372; 21, IV, pp. 262–263; 22, IV, p. 353.

[a] See also Third Ann. Rept. U. S. Reclamation Service, p. 404.

Bulletins: 131, pp. 46–47; 140, pp. 178–179.

Water-Supply Papers: 11, p. 67; 16, pp. 132–133; 28, pp. 120, 128; 37, pp. 283–284; 50, pp. 352–353; 66, p. 70; 75, pp. 155–156; 84, pp. 181–183; 99, pp. 378–382; 132, pp. 67–71; 174, pp. 49–53; 210, pp. 55–57; 248, pp. 45–50.

Further information relative to the quality of water in the Rio Grande near El Paso is contained in Bulletin 34, New Mexico Agricultural Experiment Station, "Principles of water-analysis," by Arthur Goss, 1900.

Partial analyses, gage heights, and rates of discharge of water and solids for Rio Grande at Courchesne, near El Paso, Tex.

[Drainage area, 38,600 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–1907.									
January 8	6	.....	128	534	678	6.3	385	556	705
January 11	20	156	98	1,090	618	7.2	765	2,260	1,280
January 14	0	272	62	2,030	528	7.7	1,080	5,910	1,540
January 21	0	258	100	846	638	7.0	605	1,380	1,040
January 28	0	184	113	758	662	6.7	540	1,100	965
February 4	0	222	113	786	654	6.5	460	976	812
February 19	11	170	106	1,940	690	7.2	720	3,780	1,340
February 21	0	198	71	2,090	544	8.0	1,220	6,880	1,790
February 28	0	186	78	2,310	544	8.0	1,300	8,100	1,910
March 3	0	192	56	1,950	850	9.2	2,500	13,100	5,740
March 9	0	199	49	14,500	716	10.1	3,910	153,000	7,550
March 21	0	166	42	7,300	570	10.3	3,170	62,400	4,880
April 17	0	169	52	4,750	534	9.6	1,980	25,400	2,860
April 14	.....	.....	67	7,010	564	10.4	2,930	55,400	4,460
April 19	0	168	45	9,180	552	10.6	3,330	82,500	4,960
April 29	0	180	74	17,400	764	12.9	7,300	343,000	15,100
May 4	0	178	40	6,990	454	11.7	5,530	104,000	6,780
May 9	0	183	42	7,110	448	13.5	9,760	187,000	11,800
May 13	0	190	41	6,730	464	11.6	5,960	108,000	7,470
May 19	0	195	42	5,130	440	12.2	6,020	83,500	7,150
May 25	0	173	39	4,360	324	14.6	10,200	120,000	8,920
June 6	0	141	23	4,510	402	14.2	15,600	190,000	16,900
June 13	0	154	27	4,610	284	14.8	23,000	286,000	17,600
June 19	0	151	26	4,630	296	13.4	13,600	170,000	10,900
June 26	0	.....	28	4,400	410	10.7	4,950	58,800	5,480
July 1	0	152	113	2,380	396	9.4	3,150	20,300	3,370
July 13	0	136	88	928	404	7.4	735	1,840	802
July 22	21	135	233	130	872	6.7	385	135	906
July 25	0	161	136	290	660	6.8	435	341	775
July 28	23	138	178	216	746	6.7	380	224	765
August 3	0	184	175	228	758	6.4	210	129	429
August 10	0	174	103	20,900	868	7.0	600	33,900	1,410
August 11	6	192	117	17,800	848	7.0	570	27,300	1,300
August 12	6	161	71	28,900	860	7.6	950	74,100	2,210
August 15	0	157	106	22,000	902	6.8	470	27,900	1,140
August 18	0	167	187	12,400	1,060	6.4	300	10,000	855
August 21	0	234	275	902	1,190	6.2	200	487	645
August 24	0	209	362	378	1,350	6.0	145	148	530
August 27	19	173	494	270	1,700	5.8	100	73	458
August 30	35	172	759	152	2,490	5.6	50	21	335
September 2	18	219	1,070	8	3,470	5.4	35	1	328
September 5	15	.....	1,230	334	3,720	5.4	30	27	302
September 8	16	219	1,080	202	3,330	5.4	35	19	315
September 11	7	239	1,220	264	3,730	5.3	25	18	252
September 14	0	178	233	440	948	5.9	110	122	281
September 17	0	179	285	376	1,090	5.7	75	76	221

Partial analyses, gage heights, and rates of discharge of water and solids for Rio Grande at Courchesne, near El Paso, Tex.—Continued.

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–1907.									
September 20	0	213	582	118	2,250	5.5	45	14	274
September 23	0	262	1,020	216	3,250	5.2	20	12	176
September 26	0	240	1,240	134	3,880	5.2	15	5	157
September 29	0	167	131	2,280	686	6.2	165	1,020	306
October 2	0	167	130	18,300	716	6.4	195	9,600	376
October 5	0	189	205	39,100	1,530	6.0	130	13,700	536
October 8	0	.....	318	34,300	1,940	5.8	90	8,330	471
October 11	0	224	458	6,620	1,800	5.6	60	1,070	292
October 14	0	246	640	6,600	2,220	5.5	45	802	269
October 20	0	251	797	1,950	2,470	5.3	25	132	166
October 23	0	258	736	818	2,350	5.3	30	66	190
October 26	0	229	562	674	1,850	5.4	40	73	200
October 29	0	244	561	860	1,800	5.4	40	93	195
November 1	8	218	467	706	1,470	5.5	35	67	139
November 4	10	194	401	694	1,320	5.6	75	140	266
November 7	0	182	247	2,360	994	5.8	115	735	308
November 10	4	162	154	6,580	702	6.2	200	3,550	379
November 15	12	149	102	15,900	704	6.7	380	16,200	720
November 18	13	142	127	15,400	822	6.7	340	14,100	755
November 21	0	174	128	8,910	712	6.6	310	7,460	596
November 24	0	164	76	7,880	546	6.6	335	7,130	495
November 27	0	180	84	23,300	612	7.8	1,240	78,000	2,050
November 30	0	154	49	16,900	508	8.3	1,560	71,000	2,140
December 3	0	169	68	13,600	572	8.2	1,350	49,800	2,090
December 6	0	173	86	13,800	658	7.2	690	25,600	1,230
December 9	0	175	89	10,100	618	6.9	540	14,700	900
December 12	0	165	88	6,050	600	7.0	595	9,700	964
December 15	0	168	81	5,780	576	7.0	570	8,890	885
December 18	0	168	95	5,040	552	7.0	580	7,890	864
December 21	0	168	99	5,270	550	7.0	580	8,250	861
December 24	0	172	107	4,020	520	6.9	455	4,940	638
December 27	0	178	99	3,840	534	6.8	450	4,680	649
December 30	0	196	180	1,550	756	6.3	280	1,170	571
January 1	0	199	207	1,060	958	6.2	220	630	570
January 4	24	185	246	896	932	6.0	165	399	415
January 7	14	205	254	894	890	6.0	175	422	421
January 10	22	193	260	698	980	6.0	175	330	463
January 13	0	224	199	1,170	856	6.3	240	760	555
January 16	0	231	166	1,120	752	6.3	240	728	487
January 18	0	204	116	5,370	610	7.2	520	7,540	856
January 21	0	175	76	6,460	480	7.6	945	16,500	1,220
January 24	0	168	72	6,170	524	7.8	1,040	17,300	1,470
January 27	0	172	87	4,280	544	7.0	560	6,480	824
January 30	0	181	83	3,390	528	7.0	515	4,710	753
February 2	6	162	87	3,880	500	7.0	490	5,130	662
February 5	0	174	103	3,480	586	7.0	470	4,420	743
February 8	0	158	99	3,360	540	7.0	470	4,260	685
February 11	0	166	86	6,060	580	7.3	595	9,730	932
February 14	0	159	80	5,670	556	7.4	715	10,900	1,070
February 17	0	154	76	5,500	464	7.6	795	11,800	995
February 20	15	124	99	5,090	506	6.3	635	8,710	867
February 23	0	185	113	4,660	542	7.2	555	6,980	811
February 26	0	198	113	3,980	570	7.0	485	5,230	747
March 2	0	178	82	4,270	518	7.0	515	5,940	720
March 5	0	159	102	3,510	620	6.9	425	4,030	711
March 8	0	169	101	2,870	596	6.9	395	3,060	635
March 11	0	174	121	3,040	592	6.8	370	3,040	591
March 14	0	182	138	2,390	694	6.7	270	1,740	506
March 17	0	170	100	2,970	584	6.8	280	2,250	442
March 20	0	162	79	4,780	476	7.3	580	7,490	745
March 23	0	166	97	6,980	634	7.2	520	9,770	889
March 26	8	142	97	6,470	678	6.8	355	6,210	651
March 29	0	166	165	4,800	784	6.6	235	3,050	497
March 31	0	160	112	14,600	658	7.5	770	30,400	1,370
April 2	0	160	68	13,800	630	8.2	1,340	50,000	2,280
April 5	0	150	68	18,300	682	8.1	1,210	59,700	2,230
April 8	0	144	63	14,200	592	7.8	970	37,200	1,550

Partial analyses, gage heights, and rates of discharge of water and solids for Rio Grande at Courchesne, near El Paso, Tex.—Continued.

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–1907.									
April 11	4	129	78	8,700	554	7.6	780	18,300	1,170
April 14	0	77	58	9,890	470	8.2	1,150	30,700	1,460
April 15	0	140	39	7,320	356	8.6	1,060	21,000	1,020
April 17	0	156	63	10,700	572	8.6	1,070	42,300	2,270
April 20	0	144	57	7,870	470	8.0	1,170	24,900	1,490
April 23	0	134	48	11,400	492	8.7	1,710	52,800	2,270
April 26	0	206	44	10,200	502	8.8	1,870	51,300	2,530
April 28	0	156	39	10,200	464	9.5	2,850	73,300	3,570
April 30	0	147	34	9,280	420	10.0	3,470	87,000	3,940
May 3	0	147	34	7,270	346	9.8	3,700	72,600	3,460
May 6	0	134	24	6,260	354	9.3	2,760	46,700	2,640
May 9	0	128	25	6,060	276	9.5	2,810	46,000	2,090
May 12	0	140	29	7,240	382	10.6	4,740	92,700	4,890
May 15	0	80	34	9,320	426	11.4	5,840	147,000	6,710
May 18	0	73	34	6,850	364	12.0	7,330	136,000	7,200
May 20	9	98	32	7,190	330	11.6	6,390	124,000	5,690
May 23	0	137	29	7,490	348	11.8	6,990	141,000	6,560
May 26	0	128	29	6,400	370	12.4	8,460	146,000	8,450
May 29	13	830	39	7,240	328	12.4	8,140	159,000	7,210
June 1	0	134	34	7,480	348	11.4	6,120	124,000	5,750
June 4	0	140	34	8,720	338	10.6	4,470	105,000	4,080
June 7	0	118	30	8,800	286	10.0	4,360	104,000	3,370
June 10	0	134	30	10,900	298	10.0	3,610	106,000	2,900
June 13	0	134	30	10,400	266	10.0	3,730	104,000	2,680
June 16	0	131	25	11,500	272	11.0	4,770	148,000	3,500
June 19	0	140	30	12,100	294	11.4	5,770	189,000	4,650
June 22	6	102	30	13,600	274	11.8	6,500	238,000	4,810
June 25	0	129	30	12,900	272	10.9	4,720	164,000	3,460
June 28	0	128	20	9,210	266	9.8	2,910	72,400	2,090
June 30	0	108	30	6,440	246	9.4	2,210	38,400	1,470
July 3	0	255	25	3,850	280	8.7	1,390	14,400	1,050
July 6	12	77	30	4,690	252	8.6	1,280	16,200	871
July 9	0	140	30	5,950	354	9.0	2,030	32,600	1,940
July 12	0	144	30	9,810	420	9.4	2,590	68,600	2,940
July 15	0	160	30	10,500	434	8.8	1,660	46,800	1,940
July 18	0	141	30	8,010	364	8.8	1,770	38,300	1,740
July 21	0	154	25	7,690	340	8.9	1,840	38,100	1,690
July 24	0	138	30	9,460	348	8.8	1,510	38,600	1,420
July 27	0	72	30	8,400	378	8.1	1,060	24,100	1,080
July 29	0	65	30	6,300	336	8.0	990	16,800	897
July 31	26	36	30	4,800	276	7.9	680	8,800	506
August 3	0	144	30	18,600	204	8.7	1,430	71,700	788
August 6	0	147	35	19,400	416	8.7	1,610	84,400	1,810
August 9	0	278	40	11,600	466	8.2	1,230	38,400	1,550
August 12	0	160	28	11,000	370	8.0	805	23,800	803
August 15	0	140	40	10,700	408	7.7	505	14,500	558
August 18	0	137	64	13,700	562	6.9	355	13,200	539
August 21	0	155	60	9,130	500	6.7	250	6,170	338
August 24	0	146	74	5,090	506	6.6	240	3,300	328
August 27	0	154	97	3,870	620	6.0	120	1,250	201
August 30	0	141	42	13,180	300	7.2	545	19,400	442
September 2	0	151	68	3,920	418	6.2	150	1,590	169
September 5	0	171	147	3,440	722	5.8	65	605	126
September 8	9	204	229	646	1,130	5.4	40	70	122
September 11	0	246	390	128	1,650	5.2	20	7	89
September 14	0	252	467	124	1,920	5.0	20	7	104
September 17	38	216	534	116	2,110	5.0	10	3	57
September 21	13	183	590	778	1,630	5.0	10	21	44
September 24	0	205	466	124	1,680	5.1	15	5	68
September 27	0	233	641	390	2,440	4.8	15	16	99
September 30	0	164	72	4,050	480	5.9	140	1,530	182
October 1	5	163	69	83,900	1,170	8.4	1,240	281,000	3,930
October 3	10	124	73	45,000	1,120	7.3	580	70,500	1,760
October 6	0	141	81	31,600	1,100	7.1	435	37,100	1,290
October 9	0	153	39	20,200	554	7.4	650	35,400	973
October 11	0	135	47	13,800	492	7.5	720	26,700	956
October 16	3	139	32	11,400	396	7.2	560	17,300	599
October 18	0	127	31	8,980	338	7.0	505	12,300	461

Partial analyses, gage heights, and rates of discharge of water and solids for Rio Grande at Courchesne, near El Paso, Tex.—Continued.

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–1907.									
October 21	0	131	35	7,970	316	7.0	505	10,900	431
October 24	0	126	37	7,230	308	7.0	490	9,580	408
October 27	0	137	45	9,850	392	7.6	820	21,800	869
October 30	0	133	39	7,630	366	7.2	565	11,600	559
November 2	0	139	46	8,990	450	7.4	760	18,400	923
November 5	0	116	50	10,600	426	7.8	1,180	33,600	1,360
November 8	0	142	31	10,200	324	8.1	1,140	31,200	996
November 11	0	150	80	8,990	444	8.1	1,240	30,100	1,490
November 14	0	134	35	8,580	288	8.1	1,150	26,700	895
November 18	0	142	29	7,550	300	8.0	1,030	21,000	835
November 21	0	137	32	6,130	254	8.1	1,110	18,400	761
November 24	0	151	32	8,460	272	8.0	980	22,400	720
November 27	0	126	39	4,510	242	7.6	550	6,700	359
November 29	0	138	39	4,230	244	7.5	550	6,290	362
December 2	0	128	34	5,270	268	8.1	1,000	14,300	724
December 5	0	148	41	16,800	264	10.2	3,670	166,000	2,620
December 8	0	206	58	7,390	508	8.4	1,510	30,200	2,070
December 11	0	136	52	13,100	534	8.5	1,560	55,200	2,250
December 14	0	129	45	7,640	444	8.3	1,110	22,900	1,330
December 17	0	129	40	2,950	334	8.2	1,170	9,300	1,050
December 20	0	130	46	3,200	330	8.0	1,170	10,100	1,040
December 23	0	155	56	3,400	364	7.6	810	7,450	796
December 26	0	142	53	2,720	338	7.2	600	4,400	547
December 29	0	141	54	3,490	350	7.8	940	8,870	888
December 31	0	144	50	3,620	378	7.8	810	7,940	828
January 3	0	143	49	3,560	322	7.9	940	9,050	817
January 6	0	174	57	4,000	388	7.7	835	9,020	875
January 9	0	135	54	4,020	326	7.5	720	7,800	634
January 12	0	144	56	5,190	324	7.7	905	12,700	792
January 15	0	140	59	4,190	350	8.0	1,300	14,700	1,230
January 19	0	140	46	6,860	314	8.4	1,400	25,900	1,190
January 22	0	144	54	4,510	358	8.1	1,210	14,800	1,170
January 25	0	164	56	3,220	428	7.8	960	8,330	1,110
January 28	0	152	56	2,360	352	7.6	630	4,030	599
January 31	0	142	56	2,500	364	7.7	660	4,460	649
February 3	0	143	46	2,770	316	7.8	875	6,550	747
February 6	0	126	46	2,910	348	8.0	1,000	7,850	940
February 9	0	136	46	4,110	358	8.1	920	10,200	890
February 12	0	138	46	4,010	368	8.0	905	11,800	900
February 15	0	136	46	4,310	270	7.9	800	9,300	584
February 18	0	141	46	3,850	374	7.8	800	8,320	808
February 21	0	131	46	3,430	218	7.7	785	7,260	462
February 24	0	136	58	3,230	470	7.8	750	6,540	951
February 28	0	138	52	3,590	400	7.8	820	7,950	886
March 3	0	138	57	4,250	430	8.0	950	10,900	1,100
March 6	0	138	52	3,990	436	7.8	825	8,890	970
March 9	0	134	52	3,040	420	7.7	585	4,810	664
March 12	0	134	57	2,890	410	7.6	595	4,650	659
March 15	0	138	52	3,750	440	7.9	825	8,350	980
March 18	9	215	28	5,010	400	8.0	960	13,000	1,040
March 21	5	146	62	2,310	434	7.4	540	3,370	632
March 21	0	143	51	3,390	400	7.4	520	4,750	561
March 24	9	139	62	2,200	440	7.4	510	3,030	606
March 27	9	139	52	8,900	440	9.0	2,060	49,500	2,450
March 29	0	153	41	10,200	390	9.2	2,380	65,500	2,510
March 31	19	124	41	9,430	352	9.0	1,980	50,400	1,880
April 3	5	129	36	6,700	320	8.6	1,740	31,400	1,500
April 6	0	129	42	4,550	266	8.4	1,440	17,700	1,030
April 9	0	126	36	5,100	300	8.4	1,370	18,900	1,110
April 12	0	124	47	4,490	278	8.4	1,330	16,100	1,000
April 15	0	124	36	4,600	306	8.2	1,280	15,900	1,040
April 17	0	148	46	7,550	386	9.6	3,080	62,900	3,210
April 19	0	150	46	12,100	352	11.0	5,070	165,000	4,820
April 21	0	134	43	12,800	340	11.2	6,060	210,000	5,570
April 24	0	134	46	11,600	340	11.0	5,810	181,000	5,330
April 27	0	134	43	10,300	364	10.0	3,750	104,000	3,690
April 30	0	124	37	7,680	358	9.5	3,000	62,200	2,900

Relative amount of substances in solution in water from Rio Grande at Courchesne, near El Paso, Tex.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+^{3}_{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905–1907.											
January 8–28	5	+4.0	594	14	2.5	16	0.00	33	24	17	0.01
February 24–28	4	+5.2	595	16	2.2	16	1.6	39	25	15	.02
March 3–21	3	.....	670	19	2.5	14	.00	28	41	.....	.06
April 7–29	4	+4.8	658	18	2.4	15	.00	32	37	9.6	.02
May 4–25	5	+1.6	474	19	2.5	15	.00	41	30	9.7	.05
June 6–26	4	+7.3	363	24	2.7	12	.00	59	22	8.8	.05
July 1–25	3	+4.4	417	17	2.4	16	.00	37	24	17	.03
August 10–30	9	.....	1,360	.....	2.0	19	.00	16	33	21	.01
September 2–29	10	.....	2,680	9.8	1.8	.....	.00	.....	28	31	.004
October 2–29	9	.....	1,880	11	2.0	.....	.00	13	30	27	.002
November 1–24	8	+2.3	912	11	2.4	21	.00	21	29	23	.01
November 27–December 18	8	− .1	600	13	2.3	17	.00	30	33	13	.04
December 24–January 30	14	+1.9	723	13	2.2	19	.00	28	25	21	.01
February 2–26	9	.....	519	.....	3.1	19	.00	31	29	17	.03
March 2–31	9	−3.0	627	11	2.2	17	.00	29	30	17	.03
April 2–30	10	.....	522	.....	2.5	16	.00	35	32	11	.02
May 3–29	10	−1.9	357	16	3.1	13	.00	46	29	11	.01
June 1–28	10	+2.0	324	14	2.6	14	.00	47	22	7.4	.00
June 30–July 27	10	.....	350	18	3.1	15	.00	50	.....	7.1	.00
July 29–August 30	14	+4.7	461	16	3.0	15	.00	38	29	11	.00
September 2–30	10	.....	1,480	11	2.1	22	.00	14	.....	26	.003
October 1–27	10	+ .2	656	14	2.4	15	.00	25	42	9.8	.002
October 30–November 29	11	+1.8	404	16	3.2	16	.00	43	32	11	.10
December 2–31	11	+3.5	372	16	3.2	16	.00	41	28	14	.59
January 3–31	10	+4.9	374	16	3.2	14	.00	38	23	14	.24
February 3–March 3	10	+5.7	442	15	2.5	14	1.1	32	26	11	.50
March 6–April 9	10	+2.4	422	16	3.6	16	.00	37	37	12	.....
April 6–30	10	+6.5	348	19	2.8	14	.00	40	30	11	.....
Mean	.....	3.4	699	15	2.6	16	.10	34	30	15	.07

Monthly discharge, in second-feet, of Rio Grande near El Paso, Tex.

Month.	1889.	1890.	1891.	1892.	1893.	1897.[a]	1898.	1899.	1900.
January	.....	196	451	326	134	50	490	210	132
February	.....	290	809	476	144	182	606	204	102
March	.....	424	1,870	752	35	161	326	115	8
April	.....	2,190	4,260	3,150	808	2,160	1,650	148	5
May	[b] 3,120	5,770	11,900	7,090	3,760	8,300	2,280	168	729
June	2,640	4,400	6,710	2,940	225	6,100	1,880	0	1,560
July	237	854	2,270	668	.....	1,330	3,190	318	1
August	0	734	662	13	.....	132	508	7	0
September	0	176	768	0	.....	705	38	0	277
October	0	65	1,490	0	.....	1,760	3	2	0
November	0	284	341	0	.....	1,170	2	2	0
December	71	535	344	0	.....	654	93	46	12
The year	.....	1,330	2,650	1,280	.....	1,900	922	102	235

Month.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	Mean.
January	5	135	10	16	584	439	983	536	294
February	81	104	23	7	780	571	839	542	360
March	60	10	368	0	3,060	412	976	777	585
April	0	133	831	0	3,330	1,480	2,950	1,350	1,530
May	2,570	9	3,310	0	8,880	5,680	4,380	5,590	4,320
June	1,300	5	9,860	0	14,300	4,550	7,440	675	3,800
July	205	0	2,570	0	956	1,570	5,490	265	1,250
August	986	236	70	120	322	799	2,200	954	484
September	353	156	17	184	56	47	2,800	240	364
October	87	23	33	5,960	69	621	813	0	683
November	215	5	5	813	428	997	923	85	330
December	130	29	40	621	610	1,240	612	380	338
The year	503	70	1,430	643	2,780	1,530	2,540	950	1,190

[a] Revision of previous estimates appearing in Third Ann. Rept. U. S. Reclamation Service, p. 404.
[b] Approximate.

RIO GRANDE NEAR SAN MARCIAL, N. MEX.

Samples of water were collected from Rio Grande at a railroad bridge near San Marcial, N. Mex., from May 28, 1905, to April 27, 1907. A gaging station was established by the United States Geological Survey near San Marcial January 29, 1895. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for the station have been published by the Survey in the following reports:[a]

Annual reports: 11, II, p. 107; 18, IV, pp. 254–257; 19, IV, pp. 387–389; 20, IV, pp. 58, 358, 371; 21, IV, p. 261; 22, IV, p. 352.

Bulletins: 131, p. 46; 140, pp. 177–178.

Water-Supply Papers: 11, p. 66; 16, p. 131; 28, pp. 120, 128, 129; 37, pp. 282–283; 50, pp. 351–352; 66, pp. 68–69; 75, p. 155; 84, pp. 183–186; 99, pp. 382–386; 132, pp. 62–67, 127; 174, pp. 43–48; 210, pp. 52–56; 248, pp. 40–45.

Partial analyses, gage heights, and rates of discharge of water and solids for Rio Grande at railroad bridge near San Marcial, N. Mex.

[Drainage area, 30,000 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–1907.									
May 28, 30, June 3, 6, 12, 15	0	128	21	4,540	286	12.2	18,800	231,000	14,500
June 18, 21, 24	0	113	22	4,290	244	9.2	9,630	111,000	6,350
June 26, 28, 30, July 3, 6, 9, 12	0	126	13	1,390	218	7.7	2,040	7,640	1,190
July 15, 18, 21, 24, 27	13	129	62	20,400	908	6.4	176	9,670	431
July 31, August 3, 6, 15, 18, 21	0	178	53	23,200	656	6.5	344	21,500	610
August 24	0	194	35	782	824	5.6	5	11	11
September 9	10	186	94	102,000	1,930	6.7	150	41,300	781
September 25	0	158	.....	4,400	1,160	5.6	50	595	157
September 27	0	193	94	99,200	1,790	7.3	400	107,000	1,940
September 29	0	154	85	50,900	1,440	6.7	230	31,600	890
October 2	0	168	50	31,900	836	6.2	170	14,600	384
October 5	6	191	51	29,200	834	6.0	160	12,600	360
October 10	0	170	44	12,900	578	5.6	85	2,970	133
October 11	0	180	49	8,870	594	5.6	85	2,040	137
October 14	12	156	42	7,470	450	5.7	95	1,920	115
October 17	12	159	40	7,200	454	5.7	80	1,550	98
October 20	12	161	50	6,060	444	5.7	85	1,390	102
October 23	5	161	48	5,970	430	5.8	95	1,530	110
October 26	2	151	39	7,410	432	5.9	125	2,500	146
October 28	6	158	44	6,850	490	6.0	150	2,770	198
October 31	0	179	41	7,950	488	6.2	170	3,650	224
November 3	0	174	47	7,180	426	6.2	175	3,390	201
November 9	0	182	60	15,400	522	7.0	690	28,600	972
November 11	0	192	95	642	826	7.0	665	1,150	1,480
November 14	0	169	59	8,590	498	7.0	550	12,800	740
November 17	8	158	63	6,600	536	6.8	480	8,550	693
November 20	7	148	53	5,540	532	6.8	480	7,160	688
November 23	0	153	41	7,430	384	7.0	605	12,200	629
November 25	0	149	42	31,900	600	7.8	1,920	166,000	3,110
November 28	0	158	53	13,600	600	7.0	620	22,700	1,000
November 30	0	160	69	24,500	758	7.7	1,530	101,000	3,130
December 3	0	168	42	13,400	472	7.3	815	29,600	1,040
December 6	0	164	35	6,510	436	7.2	505	8,890	595
December 9	0	165	38	5,700	382	7.2	565	8,680	582
December 12	0	165	42	4,550	418	7.2	605	7,430	683
December 15	0	155	49	4,830	452	7.4	740	9,680	903
December 18	0	165	53	3,920	432	7.3	620	6,560	723
December 21	0	155	46	3,890	362	7.4	645	6,770	631
December 24	0	178	53	2,090	416	6.9	230	1,300	258
December 27	0	208	88	710	554	6.5	175	336	262

[a] See also Third Ann. Rept., U. S. Reclamation Service, pp. 412, 415.

Partial analyses, gage heights, and rates of discharge of water and solids for Rio Grande at railroad bridge near San Marcial, N. Mex.—Continued.

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solid (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905—1907.									
December 30	0	205	70	1,190	504	6.5	185	595	252
January 2	0	222	94	348	600	6.5	125	118	203
January 5	18	202	72	914	560	7.0	280	691	423
January 8	2	195	58	682	422	6.8	240	443	273
January 11	6	183	64	616	428	7.2	285	474	329
January 14	0	165	51	2,170	404	7.2	515	3,020	563
January 17	0	152	58	5,830	396	7.9	1,250	19,600	1,340
January 20	0	145	40	7,750	402	7.9	1,310	27,400	1,420
January 23	0	175	51	5,820	576	7.2	700	11,000	1,090
January 26	0	158	43	1,950	386	7.2	485	2,550	505
January 29	0	158	40	3,590	358	7.4	805	7,820	780
January 31	0	163	46	3,220	450	7.1	650	5,660	790
February 3	0	172	47	6,380	510	7.3	625	10,800	860
February 6	0	160	56	10,350	570	7.5	705	19,700	1,090
February 9	0	155	40	6,090	412	7.4	635	10,400	706
February 12	0	161	44	4,990	408	7.7	795	10,500	876
February 15	0	153	48	4,560	384	7.8	875	10,800	908
February 18	0	150	42	4,750	368	7.6	780	10,000	775
February 21	0	139	46	3,290	330	7.7	720	6,400	642
February 24	.....	.....	42	2,980	282	7.6	660	5,320	502
February 27	0	139	56	3,720	360	7.6	780	7,840	758
March 3	0	144	35	3,200	348	7.4	730	6,300	686
March 6	0	208	37	3,350	368	7.6	690	6,240	686
March 9	0	126	25	2,680	332	7.5	580	4,200	520
March 12	0	119	44	2,410	332	7.6	750	4,870	672
March 15	Trace.	146	46	6,450	504	7.8	920	16,000	1,250
March 18	0	108	50	11,400	492	7.9	1,030	31,800	1,370
March 21	0	121	44	9,440	462	7.8	790	20,100	985
March 24	.....	.....	41	6,640	452	7.7	520	9,320	635
March 27	0	142	57	10,700	640	7.9	740	21,500	1,280
March 30	0	120	46	2,840	576	8.5	2,200	16,800	3,420
April 3	0	131	73	13,900	602	7.7	1,210	45,400	1,970
April 6	0	124	39	9,920	468	8.0	1,450	38,900	1,830
April 9	0	115	49	9,980	438	8.1	1,430	38,500	1,690
April 12	0	.....	36	12,900	406	8.2	1,730	60,000	1,900
April 18	0	121	33	16,300	438	8.5	2,660	117,000	3,150
April 21	3	108	19	11,400	310	9.2	3,320	102,000	2,780
April 24	0	96	19	11,600	280	9.5	4,380	137,000	3,310
April 27	0	124	14	9,050	278	9.8	5,840	143,000	4,380
April 30	10	105	14	7,030	276	9.4	4,970	94,400	3,710
May 3	0	118	10	5,880	268	9.2	4,560	72,500	3,300
May 6	0	112	10	5,380	260	9.0	4,390	63,800	3,080
May 9	.....	.....	16	6,580	216	9.9	7,080	126,000	4,130
May 12	0	118	24	9,900	324	10.5	9,370	250,000	8,200
May 15	0	105	14	5,780	236	10.3	10,400	163,000	6,650
May 18	0	115	10	4,920	246	10.1	9,650	128,000	6,410
May 22	0	99	19	6,540	252	10.9	10,800	191,000	7,360
May 25	0	102	10	5,740	212	10.8	10,200	158,000	5,840
May 28	0	121	12	4,990	232	10.5	8,910	120,000	5,590
May 31	16	61	14	3,930	220	9.5	6,380	67,800	3,790
June 3	0	105	10	3,640	206	9.1	5,320	52,200	2,960
June 7	0	96	10	4,380	206	9.3	5,300	62,700	2,950
June 10	0	108	10	3,320	212	9.4	5,430	48,600	3,100
June 13	0	96	10	3,490	192	9.8	6,240	58,800	3,240
June 16	0	96	15	4,252	170	10.4	8,500	97,700	3,900
June 19	0	106	10	4,430	188	10.6	8,330	99,600	4,230
June 26	0	86	15	1,170	202	9.0	4,330	13,700	2,370
June 29	0	99	15	2,340	186	8.4	2,710	17,100	1,360
July 2	0	105	20	8,170	356	7.9	1,710	37,700	1,640
July 5	0	96	18	6,680	234	8.5	2,310	41,800	1,460
July 8	0	121	17	9,030	364	8.7	2,580	63,000	2,540
July 11	.....	.....	10	10,600	288	8.4	2,190	62,700	1,700
July 14	.....	.....	20	6,240	230	8.4	1,930	32,500	1,200
July 17	0	109	15	5,540	258	8.4	2,110	31,600	1,470
July 20	19	72	20	7,900	284	8.7	2,640	56,400	2,030
July 23	0	122	10	4,300	284	8.2	1,760	20,400	1,350
July 26	13	85	10	2,490	222	8.0	1,170	7,850	701
July 29	19	62	15	4,020	270	7.9	1,070	11,600	780
July 31	16	85	25	8,540	338	8.4	1,450	33,400	1,320
August 3	0	.....	20	17,200	366	8.3	1,470	68,200	1,450
August 6	19	42	20	10,800	510	8.5	1,360	39,800	1,870

Partial analyses, gage heights, and rates of discharge of water and solids for Rio Grande at railroad bridge near San Marcial, N. Mex.—Continued.

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–1907.									
August 9	16	59	20	9,760	296	8.3	1,100	29,000	880
August 12	10	59	25	10,400	380	7.9	625	17,500	642
August 15	11	69	20	6,840	358	7.7	525	9,700	508
August 18	0	141	25	12,200	412	7.6	420	13,800	467
August 21	0	166	50	1,650	578	7.6	220	981	344
August 24	0	148	35	6,130	350	7.3	155	2,560	146
August 27	0	131	30	13,300	454	7.8	320	11,500	395
August 30	0	152	42	14,700	466	7.5	185	7,350	233
September 2	0	171	68	44,300	1,140	7.5	175	21,000	540
September 5	0	153	53	14,900	644	7.0	70	2,820	122
September 8	6	151	64	21,600	700	6.7	40	2,330	76
September 25	12	124	98	3,950	560	6.4	15	160	23
September 28	0	184	55	98,200	1,590	10.4	9,070	2,450,000	39,000
September 30	0	133	42	16,400	604	7.4	1,060	46,900	1,730
October 3	0	134	29	15,320	514	7.6	1,270	52,500	1,760
October 6	0	128	20	9,990	328	7.7	1,380	37,200	1,220
October 9	0	118	17	7,300	274	7.8	1,180	23,300	874
October 12	0	108	15	4,950	234	7.7	910	12,200	575
October 15	0	144	18	4,270	274	7.7	1,000	11,500	740
October 18	5	100	17	4,030	230	7.8	880	9,590	547
October 21	0	110	22	4,230	234	7.8	1,010	11,500	638
October 22	0	128	27	8,330	398	7.9	1,080	24,300	1,160
October 25	8	137	29	8,200	422	8.1	1,390	30,800	1,580
October 28	4	131	24	8,130	362	8.2	1,070	23,500	1,050
October 31	0	142	33	6,690	292	8.3	1,410	25,500	1,110
November 3	0	122	24	5,660	260	8.5	1,550	23,700	1,090
November 6	0	113	23	5,900	242	8.4	1,620	25,800	1,060
November 9	0	131	20	5,110	250	8.5	1,550	21,400	1,050
November 12	0	122	20	4,420	248	8.5	1,490	17,800	1,000
November 15	0	127	18	4,000	238	8.5	1,420	15,300	912
November 20	0	123	21	3,350	226	8.4	1,280	11,600	781
November 23	0	134	31	3,170	252	8.0	900	7,700	613
November 26	0	128	28	2,820	246	8.0	900	6,840	598
November 29	0	144	50	3,680	360	8.1	1,010	10,000	982
December 2	0	113	47	4,920	380	8.5	1,390	18,500	1,430
December 5	0	135	32	7,460	362	8.6	1,770	35,400	1,770
December 8	0	142	37	8,920	422	8.8	2,120	51,100	2,410
December 11	0	116	33	3,760	282	8.5	1,550	15,800	1,180
December 14	0	118	29	3,880	326	8.4	1,400	14,600	1,230
December 17	0	133	30	5,730	318	8.4	1,190	18,400	1,020
December 20	0	135	32	3,300	308	8.0	780	6,950	649
December 23	0	152	32	2,640	300	8.0	685	4,900	555
December 26	0	127	28	2,550	274	8.3	965	6,650	715
December 29	0	130	27	2,480	270	8.2	965	6,480	705
December 31	0	196	27	1,700	284	8.4	1,120	5,130	860
January 3	9	188	42	1,690	378	8.4	1,040	4,750	1,060
January 6	0	129	32	1,520	254	8.0	685	2,800	470
January 9	0	126	31	2,680	286	8.4	900	6,500	695
January 12	0	230	49	2,390	434	8.4	1,140	7,350	1,330
January 15	0	118	36	2,320	290	8.3	970	6,090	759
January 18	0	147	36	2,710	340	8.6	1,260	9,210	1,160
January 21	0	132	36	2,090	320	8.3	1,130	6,380	976
January 24	0	132	31	1,340	300	8.3	770	2,790	624
January 28	0	132	36	1,880	330	8.3	860	4,370	767
January 30	0	130	32	1,780	316	8.6	970	4,670	827
February 2	0	131	30	2,270	324	8.6	1,060	6,490	927
February 5	0	134	34	5,730	350	8.7	1,350	20,900	1,280
February 8	9	215	31	4,660	402	8.6	1,190	15,000	1,290
February 11	0	134	23	4,440	270	8.7	1,230	14,800	897
February 14	0	126	28	3,830	302	8.6	1,060	11,000	865
February 17	0	126	23	2,920	314	8.5	1,110	8,260	941
February 20	0	153	42	2,580	324	8.7	1,190	8,280	1,040
February 23	0	129	26	2,180	284	8.8	1,300	7,630	996
February 26	0	124	31	3,220	344	8.8	1,460	12,700	1,360
February 28	0	134	26	3,350	340	8.7	1,400	12,700	1,290
March 3	0	124	29	3,420	350	8.6	1,240	11,500	1,170
March 6	0	138	42	2,340	384	8.6	950	6,000	985
March 9	0	134	26	2,310	376	8.6	900	5,620	914
March 12	0	136	31	3,040	380	8.7	1,190	9,780	1,220
March 15	0	129	31	3,030	350	8.8	1,150	9,440	1,090
March 18	0	124	31	1,790	334	8.4	710	3,440	640

Partial analyses, gage heights, and rates of discharge of water and solids for Rio Grande at railroad bridge near San Marcial, N. Mex.—Continued.

Dates.	Analysis (milligrams per liter).					Gage height	Mean discharge (second-feet).	Solid (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).	Mean gage (feet).		Suspended matter.	Dissolved solids.
1905–1907.									
March 21	5	143	39	3,030	364	8.6	1,130	9,240	1,110
March 23	5	124	36	6,240	374	9.3	2,350	39,600	2,370
March 26	0	131	23	6,910	310	9.4	2,880	53,800	2,410
March 31	0	122	26	4,420	306	9.0	2,260	27,000	1,870
April 3	0	112	21	2,540	244	8.9	1,740	11,900	1,150
April 6	0	118	26	3,200	230	9.0	1,920	16,600	1,240
April 9	0	118	21	3,250	270	8.9	2,000	17,600	1,460
April 12	0	110	21	3,250	244	9.0	1,810	15,900	1,190
April 14	0	117	28	5,800	246	9.6	3,280	51,300	2,180
April 16	0	119	18	7,780	268	10.6	5,580	11,700	4,040
April 19	0	110	18	5,750	254	10.4	5,710	8,850	3,920
April 22	0	110	27	5,270	256	10.6	7,500	107,000	5,180
April 24	0	110	27	4,810	164	9.7	4,950	64,200	2,190
April 27	0	110	21	3,680	260	9.3	3,840	38,200	2,690

Relative amount of substances in solution in water from Rio Grande at railroad bridge near San Marcial, N. Mex.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Sulphate radicle (SO_4).	Chlorine (Cl).	Nitrate radicle (NO_3).
1905–1907.											
May 28–July 27	21	.....	418	.....	3.1	[a] 14	0.00	34	.....	10	0.05
July 31–October 5	13	+0.1	1,140	13	2.6	15	.00	17	46	8.9	.01
October 10–31	9	−2.7	464	17	2.8	14	.00	38	34	9.5	.04
November 3–25	8	−4.9	554	14	2.5	15	.00	34	41	11	.02
November 28–December 18	8	+4.3	496	14	2.4	16	.00	34	32	10	.05
December 21–January 31	15	+ .2	470	14	3.0	15	.00	39	28	13	.04
February 3–27	9	+2.2	402	14	3.2	17	.00	38	33	12	.03
March 3–30	10	− .6	466	13	3.0	15	.00	31	38	10	.01
April 3–27	10	+2.8	459	15	3.0	16	.00	37	35	9.8	.01
April 30–May 28	10	+5.1	282	16	3.9	12	.00	38	29	10	.46
May 31–July 2	10	+1.6	228	20	3.5	13	.00	67	21	8.3	.01
July 5–31	10	.....	281	18	2.9	14	.00	.....	30	7.1	.00
August 3–30	10	+5.2	411	17	3.4	16	.00	38	37	7.3	.00
September 2–October 12	10	+4.4	678	14	2.8	15	.00	24	42	8.0	.01
October 15–November 9	10	+6.5	396	17	3.3	14	.00	41	31	7.8	.00
November 20–December 11	8	+4.4	350	14	4.3	14	.00	38	29	10	.12
December 14–January 12	11	+6.8	352	17	3.1	14	.00	46	24	8.8	.12
January 15–February 11	10	.....	344	.....	3.2	.....	.00	42	25	10	.26
February 14–March 15	10	.....	390	18	2.6	13	1.2	.....	27	7.9	T.
March 12–April 9	7	.....	344	.....	3.8	15	1.4	42	24	7.8	.....
April 12–27	7	+8.5	270	20	3.1	11	.00	46	22	8.5	.....
Mean	.....	3.8	438	16	3.1	14	.12	38	31	9.3	.07

[a] Sodium is 96 per cent and potassium is 5.1 per cent of this amount.

Monthly discharge, in second-feet, of Rio Grande near San Marcial, N. Mex.

Month.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.
January	.....	[a] 600	318	938	453	660	341	370
February	986	680	438	1,070	443	632	458	314
March	2,100	679	663	1,010	448	540	246	129
April	4,690	3,140	3,570	4,560	909	105	398	674
May	3,620	2,020	12,300	2,700	570	2,010	4,160	436
June	3,920	164	6,160	2,120	16	2,690	1,620	108
July	2,430	466	1,070	2,720	462	0	964	0
August	2,910	118	100	225	104	0	1,070	800
September	.....	130	1,920	78	49	943	632	224
October	.....	742	4,580	[a] 20	11	0	277	13
November	.....	209	2,950	[a] 197	160	41	337	78
December	.....	619	2,480	380	355	164	313	184
The year	.....	797	3,060	1,330	332	669	901	278

Month.	1903.	1904.	1905.	1906.	1907.	1908.	Mean.
January	280	274	636	594	986	710	551
February	395	329	1,150	715	1,220	834	691
March	761	99	3,540	925	1,500	1,260	993
April	1,680	0	4,700	2,740	3,740	2,080	2,360
May	5,180	0	15,600	8,140	6,000	2,690	4,680
June	11,100	0	12,000	5,800	8,810	1,520	4,000
July	1,270	171	582	1,920	5,350	796	1,300
August	50	910	327	703	2,690	1,560	826
September	24	752	89	429	2,700	163	626
October	9	7,530	120	1,150	1,050	45	1,200
November	93	870	713	1,310	949	503	647
December	307	679	559	1,400	727	625	676
The year	1,760	968	3,340	2,150	2,980	1,070	1,550

[a] Approximate.

SACRAMENTO RIVER NEAR RED BLUFF, CAL.

Samples of water were collected from Sacramento River at Iron Canyon, near Red Bluff, Cal., from July 3, 1905, to March 23, 1907. A gaging station was established by the United States Geological Survey at Jellys Ferry, 12 miles above Red Bluff, April 30, 1895, and moved to a point in Iron Canyon, 4 miles above Red Bluff, in 1902. The drainage area at the upper point is 9,130 square miles and at the lower point 9,300 square miles. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for the station have been published by the Survey in the following reports:[a]

Annual Reports: 18, IV, pp. 365–369; 19, IV, pp. 509–510; 20, IV, pp. 63, 527; 21, IV, pp. 446–447; 22, IV, p. 462.

Bulletin: 140, pp. 250–252, 254.

Water-Supply Papers: 11, p. 89; 16, pp. 185–186; 28, pp. 177, 182, 185–186; 38, pp. 387–389; 39, p. 455; 51, pp. 450–451; 52, p. 523; 66, pp. 142–143, 167, 177; 75, p. 210; 81, pp. 191–198; 85, pp. 137–141; 100, pp. 278–280; 134, pp. 118–122; 177, pp. 128–130; 213, pp. 101–102; 251, pp. 154–157.

[a] See also Second Ann. Rept. U. S. Reclamation Service, p. 99.

Partial analyses, gage heights, and rates of discharge of water and solids for Sacramento River at Iron Canyon, near Red Bluff, Cal.

[Drainage area, 9,300 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–1907.									
July 3, 6, 7, 8	0	86	13	56	112	1.8	6,430	973	1,940
July 9, 10, 11, 13, 14, 15	0	101	11	14	160	1.7	6,230	236	2,690
July 16, 17, August 5, 6, 7, 8, 9, 10, 11, 12	0	101	19	8	146	1.5	5,570	120	2,200
August 13, 14, 15, 16, 17, 18, 19	0	99	15	6	140	1.3	5,170	84	1,960
August 20, 21, 23, 24, 25, 26	0	86	11	0	168	1.3	5,130	0	2,330
August 27, 28, 31, September 1, 2	0	91	8	8	138	1.2	5,050	109	1,880
September 3, 4, 5, 6, 7, 8, 9	0	87	11	6	158	1.2	5,050	82	2,180
September 10, 11, 12, 13, 14, 15, 16	0	88	11	16	110	1.2	5,050	218	1,500
September 17, 18, 19, 20, 21, 22, 23	0	86	7	0	114	1.2	5,050	0	1,560
September 24, 25, 26, 27, 28, 29, 30	0	93	14	148	140	1.3	5,100	2,020	1,930
October 1, 2, 3, 4, 5, 6, 7	0	95	14	116	130	1.3	5,120	1,600	1,800
October 8, 9, 10, 11, 12, 13, 14	0	89	12	0	198	1.3	5,150	0	2,750
October 13, 14, 15, 16, 17, 18, 19	0	93	13	48	144	1.3	5,150	668	2,000
October 22, 23, 24, 25, 26, 27, 28	0	94	7	0	142	1.3	5,170	0	1,980
October 29, 30, 31, November 1, 2, 3, 4	0	87	12	32	132	1.3	5,170	447	1,840
November 5, 6, 7, 8, 9, 11	0	90	13	14	142	1.4	5,370	203	2,060
November 12, 13, 14, 15, 16, 17, 18	0	92	14	22	126	1.4	5,530	328	1,880
November 19, 20, 21, 22, 23, 24, 25	0	90	10	2	126	1.5	5,750	31	1,950
November 26, 27, 28, 29, December 1, 2	0	86	7	4	120	1.6	6,080	66	1,970
December 3, 4, 5, 6, 7, 8, 9	0	92	18	24	134	1.6	5,780	375	2,090
December 10, 11, 12, 13, 14, 15, 16	0	86	25	0	174	1.6	5,840	0	2,740
December 17, 18, 19, 20, 21, 22, 23	0	84	11	0	144	1.8	6,560	0	2,550
December 24, 25, 26, 27, 28, 29, 30	0	89	14	40	122	1.7	6,130	662	2,020
December 31, January 1, 2, 3, 4, 5, 6	0	81	16	22	150	1.5	5,650	336	2,290
January 7, 8, 9, 10, 11, 12, 13	0	80	12	118	78	2.3	8,040	2,560	1,690
January 14, 15, 15, 17, 18, 19, 20	0	46	7	294	88	10.8	48,500	38,500	11,500
January 21, 22, 23, 24, 25, 26, 27	0	66	7	8	114	4.2	14,300	309	4,400
January 28, 29, 30, 31, February 1, 2, 3	0	79	7	0	202	3.0	10,200	0	5,560
February 4, 5, 6, 8, 10	0	80	7	8	204	2.6	8,840	191	4,870
February 11, 12, 14, 15, 17	0	67	7	162	84	5.8	21,100	9,240	4,790
February 18, 19, 20, 21, 23, 24	6	47	11	140	92	10.0	39,600	15,000	9,830
February 25, 26, 27, 28, March 1, 2, 3	0	73	14	22	102	8.8	33,500	1,990	9,230
March 5, 6, 7, 8, 9	0	72	16	90	96	7.1	25,400	6,180	6,590
March 10, 11, 12, 13, 14, 15, 16	0	56	17	82	118	8.9	34,700	7,690	11,100
March 17, 18, 19, 20, 21, 22, 23, 24	13	38	10	0	120	8.8	35,000	0	11,300
March 25, 27, 28, 29, 30, 31	0	57	10	126	88	15.3	73,100	24,900	17,400
April 1, 2, 3, 4, 5, 6, 7	0	61	10	50	86	10.3	41,900	5,660	9,730
April 8, 9, 10, 11, 12, 13, 14	0	64	10	18	126	6.8	24,600	1,200	8,370
April 15, 16, 17, 18, 19, 20, 21	18	18	5	0	126	5.7	20,000	0	6,800
April 22, 23, 24, 25, 26, 27, 28	13	32	2	48	106	5.9	20,700	2,690	5,930
April 29, 30, May 1, 2, 3, 4, 5	19	49	5	.....	180	5.4	18,700	.....	9,090
May 6, 7, 8, 9, 10, 11, 12	13	38	5	0	120	4.9	16,700	0	5,410
May 13, 14, 15, 17, 18, 19	13	41	10	74	134	4.4	14,000	2,800	5,070
May 20, 21, 22, 23, 24, 25, 26	0	57	10	54	96	4.8	16,700	2,430	4,330
May 27, 28, 29, 30, 31, June 2	0	57	5	26	104	8.2	31,600	2,220	8,870
June 3, 4, 5, 6, 7, 8, 9	0	61	10	38	152	6.8	25,400	2,510	10,400
June 10, 11, 12, 13, 14, 15, 16	10	35	10	16	122	5.6	19,400	839	6,400
June 17, 18, 19, 20, 21, 22, 23	0	74	10	46	116	4.5	15,200	1,890	4,770
June 24, 25, 26, 27, 28, 29, 30	0	73	5	40	92	3.6	12,100	1,310	3,010
July 1, 2, 3, 4, 5, 6, 7	21	29	10	30	106	3.1	10,400	842	2,980
July 8, 9, 10, 11, 12, 13, 14	0	83	5	16	138	2.7	9,310	402	3,470
July 15, 16, 17, 19, 20, 21	22	29	10	72	120	2.4	8,080	1,570	2,620
July 23, 24, 25, 26, 27, 28	13	51	10	42	132	2.1	7,250	822	2,580
July 29, 30, 31, August 1, 2, 3, 4	16	49	5	14	146	1.9	6,810	258	2,690
August 5, 6, 7, 8, 10, 11	10	65	5	0	134	1.8	6,360	0	2,300
August 12, 13, 14, 15, 16, 17, 18	0	85	10	4	146	1.7	6,190	67	2,440
August 19, 20, 21, 22, 23, 24, 25	0	82	14	0	146	1.7	6,230	0	2,450
August 26, 27, 28, 29, 30, 31, September 1	0	85	11	18	96	1.7	6,190	301	1,610
September 2, 3, 4, 5, 6, 7, 8	0	82	9	14	92	1.6	6,020	227	1,500
September 9, 10, 11, 12, 13, 14, 15	0	88	5	0	118	1.6	6,020	0	1,920
September 16, 17, 18, 19, 20, 21, 22	0	80	55	18	104	1.6	6,000	291	1,680
September 23, 24, 25, 26, 27, 28, 29	0	83	8	10	102	1.6	6,020	162	1,660
September 30, October 1, 2, 3, 4, 5, 6	0	94	8	0	130	1.6	5,860	0	2,060
October 7, 8, 9, 10, 11, 12, 13	0	86	4	36	100	1.5	6,780	562	1,560
October 14, 15, 16, 17, 18, 19, 20	0	85	9	22	148	1.6	5,900	350	2,360
October 21, 22, 23, 24, 25, 26, 27	0	94	8	58	116	1.6	5,900	924	1,850

Partial analyses, gage heights, and rates of discharge of water and solids for Sacramento River and Iron Canyon, near Red Bluff, Cal.—Continued.

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–1907.									
October 28, 29, 30, 31, November 1, 2,3	0	82	10	52	116	1.6	6,020	845	1,870
November 4, 5, 6, 7, 8, 9, 10	0	78	9	0	138	2.2	7,640	0	2,850
November 11, 12, 13, 14, 15, 16, 17	0	79	11	48	96	1.8	6,380	825	1,650
November 18, 19, 20, 21, 22, 23, 24	0	81	10	30	78	1.7	6,190	502	1,310
November 25, 26, 27, 28, 29, 30, December 1	0	83	11	16	64	1.7	6,170	266	1,070
December 2, 3, 4, 5, 6, 7, 8	0	77	10	50	60	1.9	6,720	907	1,090
December 9, 10, 11, 12, 13, 14, 15	0	50	10	104	84	4.9	17,400	4,880	3,950
December 16, 17, 18, 19, 20, 21, 22	0	58	11	14	100	2.6	8,870	336	2,400
December 23, 24, 25, 26, 27, 28, 29	0	57	10	32	148	7.3	28,800	2,490	11,500
December 30, 31, January 1, 2, 3, 4, 5	0	56	8	56	136	7.2	27,300	4,120	10,000
January 6, 7, 8, 9, 10, 11, 12	0	53	11	50	100	5.6	19,300	2,610	5,210
January 13, 14, 15, 16, 17, 18, 19	0	69	13	50	110	4.1	13,300	1,800	3,950
January 20, 21, 23, 24, 25, 26	0	71	11	58	106	4.1	13,400	2,100	3,830
January 27, 28, 29, 30, 31 February 1, 2	0	47	8	70	58	12.2	54,200	10,200	8,500
February 3, 4, 5, 6, 7, 8, 9	0	44	8	222	68	16.2	79,900	47,800	14,600
February 10, 11, 12, 13, 14, 15, 16	0	62	8	54	78	7.1	25,400	3,700	5,350
February 17, 18, 19, 20, 21, 22, 23	0	62	10	54	86	6.4	22,300	3,250	5,180
February 24, 25, 26, 27, 28, March 1, 2	0	64	8	154	70	9.2	35,700	14,800	6,750
March 3, 4, 5, 6, 7, 8, 9	0	57	5	80	46	7.3	26,100	5,640	3,240
March 10, 11, 12, 13, 14, 15, 16	0	62	10	64	106	8.2	30,600	5,280	8,760
March 17, 18, 19, 20, 21, 22, 23	0	48	5	480	102	21.3	122,000	158,000	33,600

Relative amount of substances in solution in water from Sacramento River at Iron Canyon, near Red Bluff, Cal.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905–1907.											
July 3–August 19	27	+ 7.8	148	14	6.2	[a]18	0.00	85	9.5	3.8	0.12
August 20–September 16	25	.....	144	17	5.8	14	.00	.....	9.7	8.8	.22
September 17–October 14	28	.0	141	13	5.5	13	.00	62	18	8.5	.13
October 13–November 11	27	+ 4.3	135	14	6.2	13	.00	63	13	13	.07
December 10–January 6	28	+ 5.5	127	13	5.6	14	.00	65	9.4	12	.10
January 7–February 3	28	+ 3.3	114	13	6.1	11	.00	57	8.2	16	.11
February 4–March 3	23	+ 2.5	138	14	5.5	11	.00	51	18	12	.00
March 5–31	26	− 2.1	93	16	5.3	12	.00	75	16	9.3	.10
April 1–28	28	− 6.2	102	12	5.9	8.0	.00	67	12	8.5	.04
April 29–May 26	27	.....	123	11	5.4	16	8.1	44	.....	6.5	.00
May 27–June 23	27	− 3.3	122	15	4.8	10	.00	69	11	10	.03
June 24–July 21	27	.....	120	.....	5.4	13	.00	61	.....	12	.02
July 23–August 18	27	.....	132	13	6.4	16	.00	67	.....	7.5	.00
August 19–September 15	28	+ 9.4	136	13	5.6	18	.00	62	10	11	.00
September 16–October 13	28	.....	128	13	.....	.....	.00	62	.....	.....	.03
October 14–November 10	28	+ 6.4	134	11	6.9	13	.00	58	15	9.0	.00
November 11–December 8	28	+ 3.0	116	13	6.9	13	.00	67	14	8.6	.11
December 9–January 5	28	.....	126	12	6.5	.....	.00	47	17	8.0	.17
January 6–February 2	27	+ 6.8	118	12	5.9	13	.00	50	15	11	.15
February 3–March 2	28	+ 12.0	110	14	5.5	14	.00	50	17	9.1	Tr.
March 3–23	21	.....	114	.....	5.6	16	.00	.....	16	8.8	Tr.
Mean	.....	5.2	125	13	5.9	13	.39	61	13	9.7	.07

[a] Sodium is 90 per cent and potassium is.13 per cent of this amount.

Monthly discharge, in second-feet, of Sacramento River near Red Bluff, Cal.

Month.	1895.[a]	1896.[a]	1896.[b]	1897.[b]	1898.[b]	1899.[b]	1900.[b]	1901.[b]
January	47,300	51,700	46,200	14,300	6,120	13,500	30,700	21,000
February	26,800	15,200	15,500	36,100	12,500	6,650	11,700	34,100
March	32,500	25,500	24,100	21,800	9,740	20,900	23,300	20,600
April	29,600	30,700	25,800	22,800	6,870	10,800	12,100	10,900
May	30,200	35,000	30,900	13,700	6,630	6,910	9,570	9,800
June	12,800	13,600	14,200	7,620	6,670	6,200	5,480	5,600
July	7,240	6,910	7,590	5,700	4,700	4,530	4,210	4,360
August	6,060	5,740	6,390	4,780	4,280	3,990	3,800	3,850
September	6,320	5,700	6,200	4,600	4,280	3,980	3,980	3,920
October	5,990	5,730	6,160	4,960	4,630	5,060	6,380	4,190
November	6,050	11,300	12,000	5,590	4,780	14,500	8,200	7,740
December	10,100	33,300	22,300	7,790	4,990	14,500	15,600	12,100
The year	18,400	20,000	18,100	12,500	6,350	9,300	11,200	11,500

Month.	1902.[c]	1903.[c]	1904.[c]	1905.[c]	1906.[c]	1907.[c]	1908.[c]	Mean.
January	[b] 5,380	25,600	11,500	31,800	14,700	21,500	21,000	24,100
February	69,200	17,200	46,300	26,800	23,200	45,400	23,500	26,700
March	27,400	31,600	73,300	30,900	42,500	55,700	15,000	30,300
April	22,000	18,800	38,900	18,700	26,300	32,200	12,000	21,200
May	17,800	10,900	25,100	12,800	19,400	15,400	10,900	17,000
June	10,000	6,970	12,400	8,620	18,100	12,200	7,720	9,880
July	6,190	5,590	8,660	6,080	8,530	7,500	5,540	6,220
August	5,670	4,960	6,350	5,250	6,330	6,170	4,710	5,220
September	5,010	4,810	6,530	5,060	6,020	5,710	4,570	5,120
October	5,930	5,350	11,000	5,160	5,870	5,750	5,160	5,820
November	19,800	22,000	8,930	5,620	6,570	6,100	6,050	9,680
December	17,500	13,100	13,900	6,100	15,400	11,600	6,420	13,600
The year	17,600	13,900	21,900	13,600	16,100	18,800	10,200	14,600

[a] At Red Bluff.
[b] At Jellys Ferry, 12 miles above Red Bluff.
[c] At Iron Canyon, 4 miles above Red Bluff.

SACRAMENTO RIVER AT SACRAMENTO, CAL.

Samples of water were collected from Sacramento River at Sacramento, Cal., from May 29 to December 29, 1905. A gaging station is maintained on the Sacramento River at Sacramento, and daily gage heights are published by the United States Weather Bureau. United States Geological Survey Water-Supply Paper 134, pages 146 and 147, contains daily gage heights and turbidity for 1904, and Water-Supply Paper 177, page 131, contains gage heights for the first half of 1905. The monthly discharge of Sacramento River at Collinsville, Cal. (about one-quarter greater than the discharge at Sacramento), from 1878 to 1884 is contained in Water-Supply Paper 81, pages 188–190.

Additional information in regard to the quality of the water of Sacramento River at Sacramento is contained in Water-Supply Paper 237, "Quality of California surface waters," pages 30–32.

Partial analyses and gage heights for Sacramento River at Sacramento, Cal.

[Drainage area, 25,000 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).	
1905.						
May 29, June 1, 2, 3	0	56	8	198	130	17.4
June 5, 6, 7, 8, 9, 10	0	41	9	72	64	16.3
June 12, 13, 14, 15, 16, 17	0	67	13	124	102	15.5
June 19, 20, 21, 22, 23, 24	6	56	12	318	118	13.7
June 25, 26, 27, 28, 29, 30, July 1	0	69	13	146	96	11.9
July 3, 5, 6, 7, 8	0	80	12	142	110	10.7
July 10, 11, 12, 13, 14, 15	0	85	13	186	110	9.9
July 17, 18, 19, 20, 21, 22	0	98	19	212	100	9.2
July 24, 25, 26, 27, 28, 29	32	78	20	116	148	8.5
July 31, August 2, 3, September 5, 6, 7, 8, 9, 10, 11, 12	0	102	14	130	156	7.3
September 13, 14, 15, 16, 19, 20, 21	0	90	21	128	106	6.5
September 22, 28, October 5, 13, 26, 27	0	97	11	56	134	6.5
October 30, November 1, 3, 20, 21, 22, 23	0	98	7	134	84	6.6
December 1, 2, 5, 6, 7, 9	0	82	18	38	120	7.2
December 12, 13, 15, 19	0	82	11	10	200	6.9
December 20, 21, 22, 29	0	86	12	70	212	7.4

Relative amount of substances in solution in water from Sacramento River at Sacramento, Cal.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905.											
May 29–June 24	24	.....	97	16	6.1	.....	3.8	55	14	11	0.04
June 26–July 22	23	+9.1	134	16	6.1	18	.00	64	18	12	.07
July 24–October 27	26	+6.4	149	15	6.2	15	.00	67	14	9.4	.12
October 30–December 29	21	+8.4	110	17	7.3	19	.00	78	17	10	.28
Mean	.....	8.0	122	16	6.4	17	.95	66	16	11	.13

Monthly discharge, in second-feet, of Sacramento River near Collinsville,[a] Cal.

Month.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	Mean.
January	.....	12,000	28,000	95,000	24,000	12,000	12,000	30,500
February	.....	30,000	21,000	115,000	22,000	17,000	24,000	38,200
March	.....	110,000	22,000	77,000	55,000	21,000	80,000	60,800
April	.....	110,000	95,000	90,000	90,000	73,000	105,000	93,800
May	.....	75,000	135,000	70,000	92,000	80,000	111,000	93,800
June	.....	45,000	110,000	25,000	74,000	32,000	90,000	62,700
July	.....	16,000	53,000	14,000	17,000	12,000	31,000	23,800
August	.....	8,500	18,000	8,000	8,000	7,000	12,000	10,200
September	.....	6,500	9,000	6,500	6,500	6,500	7,500	7,100
October	.....	8,000	7,500	7,000	10,000	7,000	8,000	7,900
November	8,000	7,500	7,000	8,200	14,000	7,500	.....	8,700
December	9,000	27,000	20,000	16,000	11,000	7,400	.....	15,100
The year	.....	38,000	43,800	44,300	35,300	23,500	.....	37,700

[a] Authority, state engineer.

SALMON CREEK NEAR MALOTT, WASH.

Samples of water were collected from Salmon Creek at the Jones house, near Malott, Wash., from May 23, 1905, to January 13, 1906. A gaging station was established by the United States Geological Survey near Malott, April 11, 1903. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for the station have been published by the Survey in the following reports: [a]

Water Supply Papers: 100, pp. 389–392; 135, pp. 63–65; 178, pp. 32–34; 214, p. 33; 252, pp. 122–124.

Partial analyses, gage heights, and rates of discharge of water and solids for Salmon Creek at Jones house, near Malott, Wash.

[Drainage area, 150 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–6.									
May 23, 24, 26, 27	0	98	10	90	204	1.8	165	40	91
May 28, 29, 30, 31, June 1, 2, 3	0	85	4	214	130	2.1	208	118	72
June 12, 13, 14, 15, 16, 17	0	67	4	18	108	1.8	188	9	55
June 18, 19, 20, 21, 22, July 7, 8	0	72	6	52	170	1.7	143	20	66
July 10, 11, 12, 13, 14, 15	0	75	5	10	130	1.5	92	2	32
July 16, 17, 18, 19, 20, 21, 22	0	93	7	46	156	1.3	67	8	28
July 23, 24, 25, 26, 27, 28, 29	0	99	10	12	266	1.1	38	1	27
July 30, 31, August 1, 2, 3, 4, 5	0	102	8	6	218	1.0	29	0	17
August 6, 8, 9, 10, 11, 12	0	116	11	14	196	0.9	26	1	14
August 14, 15, 16, 17, 18, 19	0	118	3	14	202	1.1	39	1	21
August 20, 21, 26, 27, 28, 29, 31	0	114	13	16	216	1.0	29	1	17
September 1, 2, 3, 4, 6, 12, 14, 15	0	112	6	38	170	0.8	20	2	9
September 15, 16, 21, 22, 23, 24, 25	0	124	4	30	236	0.7	13	1	8
September 26, 27, 28, 29, 30	0	116	6	8	212	0.8	19	0	11
October 12, 13, 14, 15, 16, 17, 18	0	118	6	36	222	0.8	17	2	10
November 7, 8, 9, 10, 11	0	129	8	24	274	0.8	15	1	11
November 12, 13, 14, 16, 17, 18	0	123	7	46	230	0.8	16	2	10
November 19, 20, 21, 22, 23	0	132	7	18	216	0.7	12	1	7
November 27, 28, December 1, 2, 4, 5, 7	0	132	7	30	246	0.6	10	1	7
December 8, 9, 12, 13, 15, 16	0	99	11	4	254	0.7	14	0	10
December 17, 18, 25, 26, 27, 28, 30	0	122	11	68	242	0.7	14	3	9
December 31, January 7, 8, 10, 12, 13	13	116	11	58	194	0.7	15	2	8

[a] See also Fifth Ann. Rept. U. S. Reclamation Service, p. 245.

Relativ. amount of substances in solution in water from Salmon Creek at Jones house, near Malott, Wash.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905–6.											
May 23–July 8	24	+10.1	124	19	4.8	14	0.00	60	19	5.6	0.07
July 10–August 5	27	+ 4.9	156	16	4.4	[a]10	.00	57	18	5.0	.08
August 6–September 15	27	+ 9.3	211	22	5.2	9.9	.00	56	27	5.2	.10
September 15–November 11	24	.....	207	23	.....	11	.00	59	32	6.8	.02
November 12–December 16	24	+ 6.8	224	21	4.1	10	.00	54	26	5.8	.....
December 17–January 7	12	.....	240	25	4.6	9.2	.00	52	29	.....	.00
Mean	.....	7.8	194	21	4.6	11	.00	56	25	5.7	.05

[a] Sodium is 88 per cent and potassium is 16 per cent of this amount.

Monthly discharge, in second-feet, of Salmon Creek near Malott, Wash.

Month.	1903.	1904.	1905.	1906.	1907.	1908.	Mean.
January	.....	15	15	13	9	10	12
February	.....	14	14	12	9	9	12
March	.....	16	36	16	11	16	19
April	[a]41	224	88	70	35	36	82
May	124	332	146	109	214	125	175
June	170	195	215	158	166	131	173
July	38	51	85	44	43	20	47
August	24	20	30	12	26	22	22
September	23	15	16	8	17	8	14
October	24	20	18	10	12	9	16
November	22	19	14	20	13	14	17
December	21	[a]17	13	11	11	8	14
The year	.....	78	58	40	47	34	50

[a] Approximate.

SALT RIVER NEAR ROOSEVELT, ARIZ.

Samples of water were collected from Salt River at a dam site near Roosevelt, Ariz., from April 9, 1905, to April 23, 1906. A gaging station was established by the United States Geological Survey on Salt River at the reservoir site February 7, 1901, and was discontinued December 9, 1907. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for the station have been published by the Survey in the following reports:[a]

Water-Supply Papers: 66, pp. 99–100; 73, pp. 26–29; 75, p. 178; 85, pp. 25–29; 100, pp. 42–45; 133, pp. 212–214; 175, pp. 173–177; 211, pp. 130–133; 249, pp. 183–186.

[a] See also First Ann. Rept. U. S. Reclamation Service, p. 93.

Information relative to the quality of Salt River near McDowell, Ariz., below the mouth of Verde River is contained in Bulletin 44, University of Arizona Agricultural Experiment Station, "The river irrigating waters of Arizona," by R. H. Forbes, 1902.

Partial analyses, gage heights, and rates of discharge of water and solids for Salt River at dam site near Roosevelt, Ariz.

[Drainage area, 5,760 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–6.									
April 9–14	6	126	29	6,270	262	16.0	22,800	386,000	16,100
April 17–22	0	117	48	532	242	9.9	8,790	12,600	5,750
April 24, 25, 26	0	102	32	1,290	176	11.6	12,200	42,600	5,800
May 2, 3, 4, 5	0	112	43	588	228	10.3	8,650	13,700	5,320
June 8, 9, 10	0	128	105	334	352	9.2	5,470	4,430	5,200
June 13, 19, 21, 23, July 22, 24	10	232	542	536	1,230	5.4	909	1,320	3,000
July 25, 26, 26, 29	15	218	524	2,750	1,150	5.1	804	5,970	2,500
July 30–August 5	0	229	355	2,850	830	5.0	634	4,870	1,420
August 6–12	0	238	528	930	1,160	4.8	562	1,410	1,760
August 18, 19, 21, 23, 24, 25	0	213	439	6,940	1,080	5.5	882	16,500	2,580
August 27, 28, 30, September 5, 14, 16, 18	10	201	423	972	1,040	4.7	518	1,360	1,450
October 10, 11, November 5–9	6	212	417	1,940	1,060	4.7	803	4,200	2,300
November 10, 11, 13–18	15	214	424	270	1,010	4.4	596	435	1,620
November 20–25	0	194	345	926	874	6.1	1,790	4,480	4,220
November 26, 27, 29, 30, December 1, 2	0	133	49	2,830	262	11.9	22,800	174,000	16,100
December 4, 6, 21, 22, 23	0	188	211	180	596	7.3	1,710	832	2,750
January 17, 18, 20, 22–25	0	172	181	226	496	7.9	2,040	1,250	2,730
January 26, 27, 29, February 6–10	0	193	218	58	674	6.8	1,170	183	2,130
February 12–17	0	132	122	162	388	7.5	2,120	928	2,220
February 19–24	0	189	124	134	412	7.1	1,470	532	1,630
February 25–28, March 1–3	9	106	126	40	386	7.2	1,520	164	1,590
March 13, 14, 15, 16	0	138	58	1,540	310	15.0	21,900	91,000	18,300
March 19–24	0	133	77	140	310	9.3	4,030	1,520	3,380
March 27–31	0	101	34	1,140	196	12.4	14,500	44,500	7,680
April 9–14	0	96	53	190	270	10.0	5,780	2,970	4,220
April 16–21	19	54	65	78	252	9.3	4,130	870	2,810
April 23	0	112	55	180	300	9.3	3,840	1,870	3,110

Relative amount of substances in solution in water from Salt River at dam site near Roosevelt, Ariz.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905–6.											
April 9–May 5	18	.....	236	.....	.....	.....	0.00	53	11	16	0.11
June 8–August 5	20	.....	854	.....	4.0	[a] 20	.00	26	.....	.....	.01
August 6–November 9	27	+3.6	1,070	8.7	2.0	28	.00	21	6.7	42	.00
November 10–December 23	25	−2.6	676	8.9	2.4	22	.00	27	8.1	38	.03
January 17–March 16	25	−3.0	496	11	2.8	20	.00	33	10	34	.01
February 19–March 3	13	+2.5	401	11	4.0	22	.00	38	11	31	.00
March 19–April 23	18	.....	266	.....	4.1	20	.00	45	12	26	.02
April 16–21	6	+1.8	271	13	4.1	18	.00	44	10	26	.01
Mean	.....	2.7	534	11	3.3	21	.00	36	9.8	30	.02

[a] Sodium is 96 per cent and potassium is 5.2 per cent of this amount.

Monthly discharge, in second-feet, of Salt River near Roosevelt, Ariz.

Month.	1888.[a]	1889.[a]	1890.[a]	1891.[a]	1892.[a]	1893.[a]	1894.[a]	1895.	1896.[a]	1897.	1898.[c]
January	.....	2,090	2,590	1,780	352	286	303	[c]5,390	447	[a]2,650	338
February	.....	1,300	5,050	19,400	[b] 221	747	288	[c]1,370	393	[a] 970	587
March	.....	4,900	3,600	2,770	[b] 230	7,730	760	[c]1,740	844	[a]2,160	688
April	.....	2,860	1,320	1,920	[b] 315	1,040	616	[c]1,710	941	[c]4,280	757
May	.....	790	695	1,830	[b] 365	602	271	[c] 673	485	[c]1,110	448
June	.....	296	322	842	[b] 110	143	166	[c] 309	204	[c] 358	237
July	.....	257	272	388	189	279	148	[a] 160	779	[c] 175	408
August	161	192	1,790	261	186	753	412	[a] 440	797	[c] 410	385
September	161	240	1,080	378	157	508	280	[a] 242	534	[c] 673	338
October	146	194	1,220	227	196	331	213	[a] 857	398	[c] 549	156
November	379	259	2,120	230	231	266	207	[a] 764	443	[c] 273	202
December	3,010	2,560	2,820	295	253	283	397	[a] 603	317	[a] 270	300
The year	.....	1,420	1,910	2,530	234	1,080	338	1,190	548	1,160	404

Month.	1899.[a]	1900.[a]	1901.	1902.	1903.	1904.	1905.	1906.	1907.	Mean.	Mean, 1901–1907.
January	356	234	582	189	207	221	1,610	1,470	3,410	1,290	1,100
February	386	221	2,420	207	318	215	8,210	1,430	2,550	2,440	2,190
March	480	230	1,630	201	600	217	15,300	7,770	3,710	2,920	4,200
April	536	315	[b]1,050	268	909	148	12,600	5,080	1,940	2,030	3,140
May	308	365	[b] 735	167	352	132	4,600	1,690	748	862	1,200
June	204	110	[b] 284	106	285	80	1,400	667	514	349	477
July	444	64	[b] 152	78	142	356	529	514	428	303	313
August	671	142	369	478	411	1,510	600	868	1,300	607	791
September	298	116	192	1,060	316	460	722	466	1,130	468	621
October	253	161	143	131	253	281	342	300	1,320	384	396
November	203	387	189	189	211	164	6,390	275	880	713	1,190
December	[a] 195	202	182	441	208	172	1,680	4,950	[b] 580	986	1,170
The year	361	212	661	293	351	330	4,500	2,120	1,540	1,110	1,400

[a] Proportional part of discharge of Salt River at Arizona Dam.
[b] Approximate.
[c] Proportional discharge of Salt River at McDowell.

SALT FORK OF RED RIVER NEAR MANGUM, OKLA.

Samples of water were collected from Salt Fork of Red River near Mangum, Okla., from April 11, 1905, to June 28, 1906. A gaging station was established by the United States Geological Survey near Mangum April 11, 1905, and was discontinued June 30, 1906. Stream-flow data, including gage heights and estimates of discharge, for the station have been published by the Survey in the following reports:

Water-Supply Papers: 173, pp. 91–93; 209, pp. 67–68.

Partial analyses, gage heights, and rates of discharge of water and solids for Salt Fork of Red River at highway bridge near Mangum, Okla.

[Drainage area, 1,220 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–6.									
April 11				956	1,970	2.8	18	46	96
April 14, 18, 19	11	153	244	1,610	2,120	3.2	569	2,470	3,240
April 26				7,430	1,050	3.1	330	6,620	933
June 6, 8, 9, 11, 12, 13	11	104	218	2,840	1,980	2.2	291	2,240	1,550
June 14, 15, 16, 17	0	118	160	940	1,800	2.0	165	419	800
June 18, 20, 21, 22, 23, 24	0	116	174	1,330	2,120	2.0	153	550	874
July 25				4,950	1,480	2.3	185	2,470	742
July 25, 26, 27, 28, 29	16	116	319	82	2,710	2.3	241	53	1,760
July 30, 31, August 1, 2, 3, 4, 5	0	115	208	1,780	1,610	2.1	145	695	629
August 6, 7, 8, 9, 10, 11, 12	0	114	139	7,560	1,460	2.1	186	3,790	735
August 13, 14, 15, 16, 17, 18, 19	0	100	125	3,160	1,520	2.3	319	2,720	1,340
August 20, 21, 22, 23, 24, 25, 27, 28	0	124	232	426	2,850		0	0	0
September 6, 7, 8, 9, 10, 11, 12	0	93	122	1,470	1,580	1.9	81	321	345
September 13, 14, 16, 24	0	138	212	72	2,750	1.6	13	3	97
November 10, 11, 12, 13, 14, 15, 16	0	155	208	1,520	2,010	2.5	216	915	1,170
November 19, 20, 21, 23, 24, 25	0	142	172	6,750	1,880	2.6	351	6,400	1,780
November 26, 28, 29, 30, December 1, 2	0	168	175	1,240	1,740	2.2	99	332	463
December 3, 5, 6, 7, 8, 9	0	165	215	554	2,390	2.2	85	127	550
December 10, 11	0	178	225	510	2,310	2.2	85	117	530
December 22	0	145	242	500	2,180	2.5	70	95	412
December 23	0	158	200	1,710	1,940	2.7	160	738	840
December 24	0	170	213	1,420	2,130	2.9	260	1,000	1,500
December 25	0	180	208	636	1,890	2.7	160	275	818
December 27	0	152	196	584	2,030	2.5	70	110	383
December 30	0	165	211	332	2,180	2.5	70	63	412
January 1	0	170	214	528	2,160	2.5	30	43	175
January 2	0	172	210	428	2,180	2.5	30	34	177
January 3	17	136	200	560	2,130	2.5	30	45	172
January 4	6	154	205	480	2,170	2.8	62	80	353
January 5	0	172	222	728	2,360	2.7	51	100	324
January 6	0	172	205	624	1,950	2.5	30	77	158
January 7	13	160	231	284	2,130	2.5	30	23	173
January 8	12	170	272	448	2,560	2.5	30	36	208
January 9	16	153	266	460	2,610	2.5	30	57	211
January 10	0	174	225	156	2,380	2.5	30	13	193
January 11	0	182	217	200	2,380	2.5	30	16	193
January 12	20	135	231	124	2,590	2.5	30	10	210
January 13	0	172	217	344	2,360	2.5	30	28	191
January 14	0	165	238	612	2,360	2.7	51	84	324
January 15	0	172	238	672	2,400	2.6	40	73	258
January 16	0	165	231	208	2,300	2.5	30	17	187
January 17	0	172	231	304	2,260	2.5	30	25	183
January 18	0	158	231	216	2,240	2.5	30	18	182
January 19	0	158	260	260	2,690	2.5	30	21	218
January 20	0	181	249	108	2,800	2.5	30	9	227
January 22	0	162	251	172	2,710	2.5	30	14	220
January 23	29	127	260	404	3,040	2.5	30	33	246

Partial analyses, gage heights, and rates of discharge of water and solids for Salt Fork of Red River at highway bridge near Mangum, Okla.—Continued.

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–6.									
January 24	0	191	271	88	3,060	2.5	30	7	248
January 25	0	185	244	116	2,740	2.4	20	6	148
January 26	0	172	240	128	2,690	2.4	21	7	153
January 27	0	184	254	84	2,760	2.4	22	5	164
January 29	0	164	235	56	2,780	2.5	30	5	225
January 30	0	164	249	148	2,680	2.5	30	12	218
January 31	0	158	262	88	2,670	2.5	30	7	217
February 2	0	158	304	348	2,660	2.5	30	28	215
February 3	0	166	189	132	2,690	2.5	30	11	218
February 5	0	173	307	92	3,240	2.3	12	3	105
February 6	0	211	310	144	3,650	2.3	12	5	118
February 7	0	230	313	336	3,600	2.3	12	11	117
February 8	0	210	254	156	3,210	2.3	12	5	104
February 9	0	198	227	84	3,010	2.3	12	3	98
February 10	0	185	227	212	2,810	2.3	12	7	91
February 12	0	144	211	904	2.480	2.3	130	317	870
February 13	0	146	209	720	2,760	2.8	130	253	966
February 14	0	172	228	1,190	1,960	2.9	180	579	954
February 15	6	142	240	1,310	1,990	2.9	180	635	968
February 19	0	185	367	556	2,620	2.6	55	83	388
February 20	0	198	346	476	2,520	2.6	55	71	373
February 21	0	203	275	572	2,520	2.6	55	85	373
February 22	0	153	262	200	2,400	2.5	26	14	169
February 23	0	153	252	248	2,460	2.5	26	17	173
February 24	0	153	257	44	2,760	2.5	26	3	193
February 25	0	166	282	104	2,750	2.4	17	5	129
February 26	0	151	232	184	2,730	2.4	8	4	59
February 27	0	185	268	240	3,220	2.3	5	3	44
February 28	0	172	251	20	3,150	2.2	3	0	26
March 2	0	209	281	348	3,300	2.1	2	2	18
March 3	0	212	281	200	3,250	2.0	1	1	9
March 4	0	230	272	252	3,520	2.0	1	1	10
March 5	0	198	279	424	3,320	2.0	1	1	9
March 6	0	190	.....	344	3,130	2.1	2	2	17
March 7	0	165	208	156	3,290	2.1	2	1	18
March 8	0	170	219	.....	3,120	2.1	2	.....	17
March 9	6	175	217	448	3,070	2.1	2	2	17
March 10	0	170	244	64	3,180	2.0	1	0	9
March 11	0	179	239	168	3,430	1.9	1	0	9
March 12	0	176	250	336	3,240	1.9	1	1	9
March 13	0	190	246	424	3,400	1.9	1	1	9
March 14	0	181	254	152	3,290	1.9	1	0	9
March 15	0	161	242	152	3,300	1.9	1	0	9
March 16	0	191	233	44	2,910	1.9	1	0	8
March 17	0	172	223	248	2,980	1.9	1	1	8
March 18	0	172	213	176	2.930	1.9	1	0	8
March 19	0	166	223	160	2,920	1.9	1	0	8
March 20	0	182	264	300	3,520	1.9	1	1	10
March 21	0	177	252	8	3,720	1.9	1	0	10
March 22	0	174	252	52	3,800	1.9	0.5	0	5
March 23	0	174	236	600	3,300	1.9	0.2	0	2
March 24	0	174	232	12	3,410	1.9	0.1	0	1
March 25	0	171	340	456	3,920	1.9	0.1	0	1
March 26	0	163	336	564	3,600	1.9	0.1	0	1
March 27	0	154	367	680	3,540	2.6	61	112	583
March 28	0	163	329	228	2,930	2.6	61	38	647
March 29	0	147	295	444	2,820	2.6	61	73	463
March 31	0	148	291	516	2,750	2.6	61	85	453
April 2	0	133	306	464	2,950	2.3	24	30	191
April 3	0	135	303	272	3,260	2.3	24	18	212
April 5	0	176	193	7,790	2,350	3.5	270	5,670	1,710
April 6	0	150	205	1,920	1,820	3.5	270	1,400	1,330
April 7	0	170	186	1,590	1,870	3.3	170	728	856
April 8	0	179	193	1,180	1,870	3.0	68	216	343
April 10	0	140	232	308	2,380	2.9	48	40	309
April 11	0	135	201	516	2,210	2.8	48	67	286
April 12	0	145	195	200	2,780	2.8	48	26	359
April 13	0	130	273	372	3,000	2.8	48	48	388

Partial analyses, gage heights, and rates of discharge of water and solids for Salt Fork of Red River at highway bridge near Mangum, Okla.—Continued.

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–6.									
April 14	0	138	251	676	2,870	2.9	60	110	465
April 15	0	133	243	0	2,760	2.9	60	0	446
April 16	0	128	213	.....	3,040	2.8	48	.....	394
April 17	0	128	213	36	2,940	2.7	40	4	318
April 18	0	140	193	.....	3,000	2.7	40	.....	324
April 19	0	140	232	2,900	2,980	2.7	40	313	322
April 20	0	134	232	3,110	2,940	3.1	97	813	769
April 21	0	147	203	1,360	1,840	3.2	103	379	511
April 23	0	153	203	1,300	1,840	3.0	58	202	288
April 24	0	140	213	204	2,260	2.9	20	11	122
April 25	0	147	222	216	2,240	2.7	20	12	121
April 26	0	128	213	232	2,370	2.7	20	13	128
April 28	0	140	203	.....	2,860	2.6	10	.....	77
April 29	0	134	203	.....	3,000	2.6	10	.....	81
May 1	0	97	136	2,000	2,630	2.6	10	54	71
May 2	0	108	136	1,340	1,900	3.0	80	288	411
May 3	0	108	155	1,500	1,940	3.0	80	324	419
May 4	0	115	155	1,410	1,990	3.0	80	304	431
May 5	0	128	193	880	2,320	2.9	60	143	376
May 6	0	128	213	852	2,420	2.9	55	127	359
May 14	0	102	77	7,110	1,550	3.0	185	3,550	777
May 15	0	128	155	2,030	1,790	3.3	400	2,190	1,930
May 17	0	115	213	444	2,420	2.8	95	114	621
May 18	0	121	203	320	2,360	2.7	95	82	605
May 19	0	121	184	292	2,350	2.6	60	47	380
May 20	0	121	203	376	2,440	2.6	60	61	396
May 21	0	121	242	184	3,040	2.5	36	18	296
May 22	0	115	242	184	3,070	2.4	15	7	124
May 23	0	96	58	2,820	1,660	3.0	185	1,410	830
May 24	0	115	106	4,820	1,120	3.3	420	5,470	1,270
May 25	0	108	106	5,160	1,410	3.3	420	5,860	1,600
May 26	0	128	164	1,500	1,860	3.0	190	773	956
May 27	0	128	184	1,460	1,730	2.8	118	466	551
May 28	0	115	184	852	2,280	2.6	60	138	369
May 29	0	121	203	460	2,290	2.5	36	45	223
May 30	0	108	203	184	2,660	2.3	12	6	86
May 31	0	108	164	140	2,730	2.3	12	5	88
June 1	0	128	198	1,580	2,880	2.7	40	171	310
June 2	0	115	59	4,860	1,580	3.5	450	5,960	1,920
June 4	0	102	69	4,120	1,590	3.5	450	5,000	1,940
June 5	0	102	69	4,380	1,460	3.0	110	1,300	433
June 6	0	102	59	4,200	1,420	2.9	81	920	312
June 7	0	121	198	700	2,460	2.8	60	113	399
June 8	0	115	188	412	2,400	2.5	25	28	161
June 9	0	134	168	104	2,760	2.5	25	7	186
June 10	0	108	149	276	2,500	2.5	25	19	169
June 11	0	115	139	280	2,470	2.5	25	19	167
June 12	0	108	149	316	2,470	2.5	25	21	167
June 13	0	128	149	348	2,480	2.5	25	23	167
June 14	0	115	188	356	2,840	2.5	25	24	192
June 16	0	121	178	324	2,830	3.0	110	96	840
June 17	0	121	198	384	2,590	2.8	65	67	455
June 18	0	121	158	320	2,520	2.8	60	52	410
June 19	0	108	178	220	2,540	2.8	48	29	328
June 20	0	114	158	.....	2,900	2.6	16	.....	125
June 21	0	128	178	.....	3,340	2.5	12	.....	108
June 22	0	114	168	.....	3,260	2.5	12	.....	106
June 23	0	114	178	12	3,520	2.5	12	0	114
June 24	0	121	178	18	3,350	2.5	12	6	109
June 25	0	96	99	1,650	1,760	2.6	16	71	76
June 26	0	103	178	132	3,560	2.5	12	4	115
June 27	0	102	178	52	3,500	2.4	10	1	94
June 28	0	114	188	172	3,430	2.3	8	4	74

Relative amount of substances in solution in water from Salt Fork of Red River at highway bridge near Mangum, Okla.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905–6.											
April 14–June 24	19	.....	1,940	.....	3.2	6.6	0.00	6.5	53	8.8	0.005
July 25–August 19	26	.....	1,760	.....	3.1	[a]6.1	.00	4.4	51	9.4	.002
August 20–November 16	26	.....	2,000	20	.....	7.4	.00	6.6	51	9.4	.....
November 19–December 11	20	−0.9	1,980	17	3.3	7.1	.00	8.0	51	10	.005
December 22–January 13	19	−1.1	2,280	12	5.6	8.3	.00	7.3	47	13	.002
January 14–31	16	+3.3	2,540	18	3.7	8.2	.00	6.4	51	9.7	.002
February 2–28	21	.....	2,740	20	3.6	7.5	.00	5.5	.....	9.0	.000
March 2–31	29	.....	3,170	20	3.3	6.1	.00	5.2	52	.....	.000
April 7–29	20	−.2	2,410	16	3.4	6.8	.00	6.1	48	8.8	.000
June 1–28	26	−.7	2,150	17	6.4	4.7	.00	6.5	62	7.2	.000
Mean	.....	1.2	2,300	18	4.0	6.9	.00	6.2	52	9.5	.002

[a] Sodium is 96 per cent and potassium is 4.8 per cent of this amount.

Monthly discharge, in second-feet, of Salt Fork of Red River near Mangum, Okla.

Month.	1905.	1906.	Mean.
January	.....	32	32
February	.....	48	48
March	.....	11	11
April	[a]382	61	222
May	439	100	270
June	165	82	124
July	98	.....	98
August	138	.....	138
September	20	.....	20
October	0	.....	0
November	149	.....	149
December	86	.....	86
Mean	.....	.....	100

[a] April 11–30.

SAN FRANCISCO RIVER NEAR ALMA, N. MEX.

Samples of water were collected from San Francisco River near Alma, N. Mex., from April 14, 1905, to April 22, 1906. A gaging station was established by the United States Geological Survey near Alma, October 18, 1904, and was discontinued December 31, 1907. Stream-flow data, including gage heights and estimates of discharge, for the station have been published by the Survey in the following reports:

Water-Supply Papers: 133, pp. 206–208; 175, pp. 166–170; 211, pp. 125–128; 249, pp. 177–180.

Partial analyses, gage heights, and rates of discharge of water and solids for San Francisco River near Alma, N. Mex.

[Drainage area, 1,800 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–6.									
April 14, 17, 20	0	150	8	1,510	282	4.0	1,020	4,150	775
April 23, 25, 27, May 10, 13, 16	8	113	11	3,750	192	3.6	781	7,900	405
May 25, 27, June 16, 19, 21, 23	0	123	50	220	296	2.1	43	26	34
June 26, July, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15	0	192	16	544	290	1.8	6	9	5
July 14, 16, 18, 20, 22	10	230	39	8,150	338	2.0	19	418	17
August 2, 3, 4, 8, 10, 12	0	158	16	2,500	228	2.3	98	665	60
August 21, 29, 31, September 2, 4, 6, 8	6	169	60	6,100	338	2.5	75	1,240	68
September 10, 13, 15, 16, 17, 18	6	188	121	1,080	474	2.1	32	93	41
September 30, October 2, 4, 6, 9, 11, 13	20	166	16	2,310	272	2.3	59	368	43
October 16, 18, 20	14	205	15	170	262	2.2	36	17	25
October 23, November 8, 10, 12, 14, 16, 18	15	170	12	1,920	312	2.6	127	658	107
December 3, 5, 7, 9	0	185	14	350	320	2.2	147	139	127
December 11, 13, 15, 16	0	208	21	344	270	1.7	48	45	35
December 19, 20, 21, 22, 23	0	221	21	372	258	1.6	41	41	29
December 25, 26, 27, 30	0	234	14	366	260	1.4	28	28	20
December 31, January 2, 3, 4, 5, 6	19	206	14	286	210	1.4	23	18	13
January 7, 8, 9, 10	0	221	18	234	262	1.5	34	21	24
January 17, 18, 19, 20	0	204	16	1,740	246	1.7	92	432	61
January 21, 22, 23, 25, 26, 27	6	181	14	570	258	1.6	58	89	40
January 28, 30, 31, February 1, 2, 3	0	199	13	928	304	1.6	52	130	43
February 4, 5, 6, 9, 10	0	182	18	1,390	274	1.8	117	438	87
February 7, 8, 11, 13, 14, 15	0	171	32	1,230	230	2.2	246	817	153
February 21, 22, 24	0	139	64	1,800	246	2.4	325	1,590	216
February 25, 26, 27, 28, March 1, 3	0	141	14	948	206	2.3	289	741	161
March 4, 5, 6, 7, 8, 9	0	147	20	976	182	2.1	215	567	106
March 11, 12, 13, 14, 15, 16	0	128	16	2,620	194	3.6	990	7,010	518
March 20, 21, 22, 23, 24, 25	0	106	29	666	182	2.7	420	755	207
March 26, 27, 31	0	83	10	1,250	152	3.0	653	2,200	268
April 1, 2, 3, 4, 5, 6	0	99	13	1,170	146	2.5	339	1,070	134
April 10, 11, 12, 22	35	0	5	246	138	2.3	261	174	97

Relative amount of substances in solution in water from San Francisco River near Alma, N. Mex.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905–6.											
April 14–July 15	30	.....	217	20	4.0	12	0.00	65	15	.....	0.14
July 14–September 18	24	+5.9	366	15	3.3	17	.00	52	10	18	.07
September 30–December 9	21	+.3	278	12	4.7	15	.00	75	9.7	7.9	.....
December 11–January 6	19	+3.1	265	17	4.2	14	.00	85	6.8	6.0	.49
January 7–February 3	20	+2.1	231	19	4.3	10	.00	83	6.5	6.5	.56
February 4–March 3	20	+4.6	220	17	5.5	12	.00	72	8.2	8.2	2.0
March 4–31	21	+8.2	202	23	3.7	8.9	.00	63	12	8.9	.64
April 1–22	10	.....	174	.....	4.8	9.8	.00	71	9.2	8.6	.10
Mean	.....	4.0	244	18	4.3	12	.00	71	9.7	9.2	.57

Monthly discharge, in second-feet, of San Francisco River near Alma, N. Mex.

Month.	1904.[a]	1905.	1906.	1907.	Mean.
January	.....	282	48	[a] 936	422
February	.....	790	222	572	528
March	.....	1,290	520	311	707
April	.....	1,220	234	168	541
May	.....	269	42	79	130
June	.....	22	4	34	20
July	.....	24	30	81	45
August	[b] 161	57	61	273	138
September	43	170	54	125	98
October	138	46	12	92	72
November	[c] 48	[a] 204	23	82	89
December	.....	[a] 66	600	68	245
The year	.....	370	154	235	253

[a] Approximate. [b] August 18–31. [c] November 1–18.

SAPELLO RIVER NEAR LOS ALAMOS, N. MEX.

Samples of water were collected from Sapello River at a ford near Los Alamos, N. Mex., from March 19, 1905, to April 5, 1906. A gaging station was established by the United States Geological Survey near Los Alamos, N. Mex., August 22, 1903. Stream-flow data, including gage heights and estimates of discharge, for the station have been published by the Survey in the following reports:

Water-Supply Papers: 99, pp. 249–250; 131, pp. 166–168; 173, pp. 63–64; 209, p. 44; 247, pp. 79–82.

Partial analyses of water of Sapello River at ford near Los Alamos, N. Mex., with gage heights.

[Drainage area, 200 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).	
1905–6.						
March 19, 20, 21, 22, 23, 24	0	150	7	128	205	1.2
March 26, 27, 28	0	137	6	188	166	1.2
April 2, 3, 4, 5, 6, 7	0	131	6	786	162	1.6
April 9, 10, 11, 12, 13, 14	1	123	7	238	174	1.8
April 16, 17, 18, 19, 20, 21, 22	0	129	4	200	160	1.7
April 23, 24, 25, 26, 27, 28, 29	Trace.	125	6	4,700	190	3.0
April 30, May 1, 2, 3, 4, 5, 6	0	120	4	478	142	2.2
May 7, 8, 9, 10, 11, 12, 13	5	110	4	248	158	1.8
May 14, 15, 17, 19, 20	6	107	7	712	164	1.7
May 21, 22, 23, 25, 26, 27	0	122	7	162	170	1.7
May 28, 29, 30, 31, June 1, 2, 3	7	113	7	94	170	1.4
June 4, 5, 6, 7, 8, 9, 10	7	124	7	112	184	1.3
June 11, 12, 13, 14, 15, 16, 17	7	126	4	284	190	1.0
June 19, 20, 21, 22, 23, 24	0	193	14	668	256	0.6
June 25, 26, 27, 28, 29, 30, July 1	0	187	21	70	278	0.4
July 2, 3, 4, 5, 6, 7, 8	0	184	12	16	360	0.2
July 9, 11, 12, 13, 14, 15	0	208	16	40	356	0.0
July 16, 17, 18, 19, 20, 21, 22	1	208	10	30	378	0.1
July 23, 24, 25, 26, 27, 28, 29	6	202	14	38	322	0.3
July 30, August 1, 2, 3, 4, 5	0	198	25	604	336	0.7
August 6, 7, 8, 9, 10, 11, 12	0	180	11	2,760	276	0.8
August 13, 14, 15, 16, 17, 18, 19	0	216	5	82	312	0.4
August 20, 21, 22, 23, 24, 25, 26	6	202	9	24	316	0.2
August 27, 28, 29, 30, September 6, 8, 9	12	185	14	5,710	326	0.3
September 10, 11, 12, 13, 14, 15, 16	11	201	14	142	292	0.1

Partial analyses of water of Sapello River at ford near Los Alamos, N. Mex., with gage heights—Continued.

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).	
1905–6.						
September 17, 18, 19, 20, 21, 22, 23	0	248	12	4	364	0.1
September 24, 25, 26, 27, 28, 29, 30	0	231	20	98	352	0.2
October 1, 2, 3, 4, 5, 6, 8	24	211	12	14	426	0.1
October 7, 9, 10, 11, 14, 15, 16	0	234	16	406	464	0.1
October 17, 18, 19, 21	3	285	16	56	512	0.1
October 22, 23, 24, 25, 26, 27, 28, 29, 30, 31	0	273	16	144	362	0.1
November 1, 2, 3, 4	6	265	16	2	488	0.1
November 5, 6, 7, 8, 9, 10, 11	0	243	13	34	386	0.1
November 12, 13, 14, 15, 16, 17, 18	13	220	11	52	420	0.1
November 19, 20, 21, 22, 23, 24, 25	0	185	13	1,370	316	0.4
November 26, 27, 29, 30, December 1, 2	0	155	17	1,500	200	1.0
December 3, 4, 6, 7, 8, 9	0	195	11	198	306	0.6
December 10, 12, 13, 14, 15, 16	0	185	21	232	268	0.5
December 18, 19, 20, 21, 22, 23	0	208	18	126	240	0.5
December 24, 25, 26, 27	0	209	11	104	270	0.5
January 1, 2, 3, 4, 5, 6	0	212	7	72	310	0.7
January 7, 8, 9, 10, 11, 12, 13	0	201	7	146	260	1.4
January 14, 15, 16, 17, 18, 20	0	195	15	192	284	1.2
January 21, 22, 23, 24, 25, 26, 27	6	195	4	98	262	0.9
January 28, 29, 30, 31, February 1, 2, 3	0	197	10	24	342	0.9
February 5, 6, 7, 8, 9, 10	0	195	7	86	264	0.8
February 11, 12, 13, 14, 15, 16	0	188	18	78	258	0.8
February 19, 20, 22, 24	0	205	14	48	290	0.8
February 26, 27, March 1, 2, 3	0	258	21	22	364	0.7
March 4, 5, 6, 7, 8, 9, 10	16	196	20	6	292	0.7
March 11, 12, 13, 14, 15, 16, 17	9	184	17	48	236	0.8
March 18, 20, 21, 22, 23, 24	0	188	12	.....	378	0.8
March 26, 27, 28, 29, 30, 31	0	145	10	106	200	1.1
April 1, 2, 3, 4, 5	0	144	5	48	210	1.2

Relative amount of substances in solution in water from Sapello River at ford near Los Alamos, N. Mex.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium (Na+K).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905–6.											
March 19–April 15	21	+4.8	186	18	4.1	14	0.00	72	18	3.8	.....
April 16–May 13	28	.....	155	.....	.....	.....	.77	78	16	2.8	0.20
May 14–June 10	25	+7.5	158	25	3.8	13	.00	79	18	4.4	.14
June 11–July 8	27	+8.1	251	23	4.4	8.4	.00	72	12	6.4	.05
July 9–August 5	26	.....	346	25	3.5	[a]7.5	1.9	.....	27	1.6	.08
August 6–September 9	27	.....	304	25	3.9	9.2	.00	68	.....	2.8	.07
September 10–October 8	28	+.9	350	26	4.4	8.6	.00	73	31	5.7	.05
October 9–November 4	27	−1.0	442	22	3.9	7.7	.00	62	31	4.3	.20
November 5–December 2	27	+2.1	319	20	3.8	10	.00	63	24	5.3	.08
December 3–27	22	+2.1	244	24	4.9	7.4	.00	73	23	5.7	.11
January 1–27	26	−1.9	264	24	3.8	6.1	.00	71	22	7.6	.05
January 28–February 24	23	.....	254	.....	.....	7.5	.00	72	27	7.1	.17
February 26–March 24	25	−.6	289	26	3.8	6.6	.00	73	22	8.3	.06
March 26–April 5	11	+9.1	209	15	4.0	19	.00	73	15	2.3	.02
Mean	.....	3.8	269	23	4.0	9.6	.19	71	22	4.9	.10

[a] Sodium is 89 per cent and potassium is 14 per cent of this amount.

Monthly discharge, in second-feet, of Sapello River near Los Alamos, N. Mex.

Month.	1905.	1906.	1907.	1908.	Mean.
January	[a] 40	32	27	2	25
February	61	16	32	3	28
March	120	16	20	3	40
April	289	54	15	16	94
May	187	64	64	2	79
June	42	25	49	2	30
July	9	19	15	1	11
August	17	8	19	28	18
September	8	7	7	5	7
October	6	9	2	2	5
November	18	12	2	2	8
December	16	120	2	2	35
Mean	68	32	21	6	32

[a] Assumed.

SHOSHONE RIVER NEAR CODY, WYO.

Samples of water were collected from Shoshone River at a wagon bridge near Cody, Wyo., from April 2, 1905, to March 30, 1906. A gaging station was established near Cody by the United States Geological Survey April 26, 1902. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for the station have been published by the Survey in the following reports:

Water-Supply Papers: 84, pp. 21–23; 99, pp. 83–85; 130, pp. 132–136; 172, pp. 113–115; 208, pp. 103–105; 246, pp. 194–197.

Partial analyses, gage heights, and rates of discharge of water and solids for Shoshone River at wagon bridge near Cody, Wyo.

[Drainage area, 1,480 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–6.									
April 2, 3, 4, 5, 6, 7	Tr.	100	7	46	188	2.8	933	116	473
April 9, 10, 11, 12, 13, 14	0	84	7	40	154	2.9	967	104	402
April 16, 17, 18, 19, 20, 21, 22	0	54	3	94	142	3.0	1,130	287	433
April 23, 24, 25, 26, 27, 28, 29	0	74	3	86	116	2.9	921	214	289
April 30, May 1, 2, 3, 4, 5	0	77	3	162	128	2.5	680	298	235
May 7, 8, 9, 10, 11, 12, 13	0	85	5	50	136	2.8	944	128	347
May 15, 16, 17, 18, 19, 20	0	70	6	218	130	3.1	1,230	724	432
May 21, 22, 23, 24, 25, 26	0	67	4	28	110	3.4	1,720	130	510
May 28, 29, 30, 31, June 1, 2	0	66	10	246	104	4.4	3,590	2,380	1,010
June 4, 5, 6, 7, 8, 9, 10	0	48	3	258	100	5.5	6,330	4,410	1,710
June 11, 12, 13, 15, 16, 17	0	56	6	144	104	5.3	5,770	2,240	1,620
June 18, 19, 20, 21, 22, 23, 24	0	52	8	82	108	4.7	4,200	930	1,230
June 25, 27, 28, 29, 30, July 1	7	37	4	202	60	5.5	6,340	3,460	1,030
July 2, 3, 4, 5, 6, 7, 8	0	39	6	76	90	5.0	4,850	995	1,180
July 9, 10, 11, 12, 13, 14, 15	0	44	8	.....	.....	4.7	4,220	.....	.....
July 16, 17, 18, 19, 20, 21, 22	0	52	31	66	116	4.5	3,630	647	1,140
July 23, 24, 25, 26, 27, 28, 29	0	53	8	182	96	4.2	3,080	1,510	799
July 30, 31, August 1, 2, 3, 4	0	60	15	156	94	3.6	2,060	867	523
August 7, 8, 9, 10, 11	0	64	9	64	150	3.6	2,080	360	843
August 13, 14, 16, 17, 18	0	61	4	76	104	2.9	1,000	205	281
August 20, 21, 22, 23, 24, 25, 26	0	70	12	50	118	2.7	843	114	269

Partial analyses, gage heights, and rates of discharge of water and solids for Shoshone River at wagon bridge near Cody, Wyo.—Continued.

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day.	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–6.									
August 27, 28, 31, September 1, 2	0	65	2	42	120	2.8	902	102	292
September 3, 4, 5, 6, 7, 8	0	84	8	184	130	2.7	772	383	271
September 10, 11, 12, 13, 14, 15, 16	0	81	8	2	146	2.5	651	4	257
September 17, 18, 19, 20, 21, 22, 23	0	93	8	.12	146	2.2	438	14	173
September 24, 25, 26, 27, 28, 29, 30	0	97	11	16	136	2.0	317	14	116
October 1, 2, 3, 4, 5, 6, 7	0	99	7	14	196	1.9	271	10	143
October 8, 9, 10, 11, 12, 13, 14	0	105	6	34	182	2.0	290	27	143
October 15, 16, 17, 18, 19, 20, 21	3	105	12	0	230	2.0	296	0	184
October 22, 23, 24, 25, 26, 27, 28	0	105	14	0	154	2.1	329	0	137
October 29, 30, November 1, 2, 3	0	124	10	54	204	2.0	295	43	162
November 5, 6, 7, 8, 9	0	118	10	34	186	2.1	382	35	192
November 11, 12, 13, 14, 15, 16, 17	0	112	11	10	192	2.0	291	8	151
November 18, 19, 20, 21, 22	0	103	7	24	214	2.0	301	20	174
December 8, 9, 10, 11, 12, 13, 14, 16	0	112	18	0	232	1.9	271	0	170
December 17, 19, 20, 30	0	109	13	112	168	1.9	269	81	122
December 31, January 1, 2, 3, 4, 5	0	111	8	96	140	1.9	258	67	98
January 7, 8, 9, 10, 11, 12, 13	0	112	11	38	166	1.9	278	28	125
January 14, 15, 16, 21, 22, 24, 25	0	92	17	22	180	2.0	303	18	147
January 26, 27, 28, 29, 30, 31, February 1	0	96	18	26	174	2.0	300	21	141
February 3, 4, 5, 9, 10	0	106	14	2	224	2.0	305	2	185
February 6, 7, 8, 11, 12, 13, 14	0	92	12	8	176	2.0	297	6	141
February 19, 20, 21, 22, 23, 24	0	99	32	24	168	2.0	295	19	134
February 25, 26, 27, 28, March 3	0	103	14	22	196	2.0	310	18	164
March 4, 5, 6, 7, 8	0	114	8	0	208	2.0	287	0	161
March 12, 13, 14, 15, 16, 17	0	127	24	62	168	2.0	302	51	137
March 18, 24	0	108	5	84	188	2.0	298	68	151
March 25, 26, 27, 28, 29, 30	0	89	10	.....	.....	2.1	348	.....	.....

Relative amount of substances in solution in water from Shoshone River at wagon bridge near Cody, Wyo.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905–6.											
April 2–29	26	+ 8.9	150	11	4.5	21	0.00	60	23	4.7	0.06
April 30–May 26	25	+ 6.6	128	14	3.8	19	.00	62	22	4.9	.03
May 28–June 24	26	.....	100	14	6.1	24	.00	55	23	7.0	.04
June 25–July 22	27	+16.7	86	15	5.0	21	.00	58	15	11	.05
July 23–August 18	23	.....	148	18	3.2	[a] 16	.....	.....	17	10	.03
August 20–September 16	25	+10.9	134	18	3.9	17	.00	58	22	5.3	.07
September 17–October 14	28	+ 3.1	176	14	3.9	18	.00	58	25	7.4	.10
October 15–November 9	24	.....	182	15	4.2	18	.00	.....	.....	6.0	.07
November 11–December 30	24	+ 3.1	186	14	4.0	16	.00	59	25	3.9	.17
December 31–February 1	27	.....	180	14	4.3	.....	.00	59	24	8.9	.24
February 3–March 3	23	+10.2	185	14	5.9	17	.00	54	28	3.8	.05
March 4–30	19	+ 6.4	180	17	4.4	17	.00	47	27	13	.00
Mean	.....	8.2	153	15	4.4	19	.00	57	23	7.2	.08

[a] Sodium is 88 per cent and potassium is 15.5 per cent of this amount.

Monthly discharge, in second-feet, of Shoshone River near Cody, Wyo.

Month.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	Mean.
January	.....	303	192	270	285	234	310	266
February	.....	283	301	351	301	291	218	291
March	.....	333	345	833	310	442	246	418
April	.....	847	1,150	972	1,030	926	1,170	1,020
May	2,700	1,560	3,770	1,400	2,890	2,520	1,970	2,400
June	5,650	6,820	7,090	5,750	4,550	5,630	5,380	5,840
July	2,780	3,560	6,590	3,890	4,860	8,280	6,680	5,230
August	1,340	1,570	2,020	1,290	1,580	2,690	2,200	1,810
September	655	235	752	559	680	1,120	744	678
October	655	577	225	295	376	641	707	497
November	.....	499	194	303	371	366	449	364
December	.....	441	*a* 200	270	313	325	219	294
The year	.....	1,420	1,900	1,350	1,460	1,960	1,690	1,590

a Revised estimate.

STONY CREEK NEAR FRUTO, CAL.

Samples of water were collected from Stony Creek at the Julian ranch, near Fruto, Cal., from September 14, 1905, to January 13, 1906. A gaging station was established near Fruto by the United States Geological Survey January 30, 1901. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for the station have been published by the Survey in the following reports:

Water-Supply Papers: 66, pp. 143–144, 178; 75, p. 211; 81, pp. 341–342; 85, pp. 135–137; 100, pp. 274–276; 134, pp. 116–118; 177, pp. 153–155; 213, pp. 108–109; 251, pp. 170–173.

Partial analyses, gage heights, and rates of discharge of water and solids for Stony Creek at Julian ranch, near Fruto, Cal.

[Drainage area, 760 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solid (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–6.									
September 14	.....	.....	.....	26	332	3.20	14	1.0	13
October 4	.....	.....	.....	122	212	3.24	18	5.8	10
October 1, 7, 14, 28, November 4, 11	12	223	42	20	318	3.25	18	1.0	15
November 18, 27, December 2, 9, 16, 23	0	224	70	138	336	3.50	51	19	46
January 1, 2, 3, 4, 5, 6	6	191	58	2	356	4.00	93	0.5	89
January 7, 8, 9, 10, 11, 12, 13	0	172	46	12	356	4.70	560	18	539

Analysis of a composite sample, October 1, 1905, to January 13, 1906, gives dissolved solids 326 milligrams per liter; and radicles, in per cent of dissolved solids, as follows: Ca, 12; Mg, 6.1; $Na+\frac{3}{4}K$, 10; CO_3, 0.00; HCO_3, 63; Cl, 17; SO_4, 7.1; and NO_3, 0.01.

Monthly discharge, in second-feet, of Stony Creek, near Fruto, Cal.

Month.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	Mean.
January	.....	114	1,420	234	2,420	2,230	2,020	1,140	1,370
February	2,710	4,200	1,090	3,800	1,470	1,540	3,310	1,680	2,480
March	893	2,590	1,660	4,360	2,050	2,500	4,430	993	2,430
April	361	1,520	892	1,600	870	1,280	1,640	525	1,090
May	349	578	276	715	675	610	450	364	502
June	66	132	16	165	206	495	236	186	188
July	7	3	7	34	36	127	47	48	39
August	4	3	10	14	12	33	15	15	13
September	35	9	8	19	14	17	19	7	16
October	130	92	16	167	16	29	30	34	64
November	161	1,580	613	71	27	61	44	88	331
December	425	1,130	462	453	68	582	597	192	489
The year	[a] 430	997	539	970	656	792	1,070	439	750

[a] Approximate.

TRUCKEE RIVER NEAR DERBY, NEV.

Samples of water were collected from Truckee River at the Reclamation Service diversion dam near Derby, Nev., from April 10, 1906, to March 13, 1907. A gaging station was established by the United States Geological Survey at Vista, Nev., August 18, 1899, and was moved to Derby, Nev., about 15 miles downstream, in 1907. The drainage area is 1,520 square miles at Vista. The flow is practically the same at both points. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for the station have been published by the Survey in the following reports:[a]

Annual Reports: 11, II, p. 102; 12, II, pp. 324, 351; 13, III, pp. 95, 99; 20, IV, p. 59; 22, IV, p. 405.

Water-Supply Papers: 38, pp. 331–332; 51, pp. 404–405; 52, p. 521; 66, pp. 113–114, 175; 81, pp. 371–373; 85, pp. 117–119; 100, pp. 185–187; 133, pp. 301–303; 176, pp. 84–86; 212, pp. 67–68; 250, pp. 111–112

[a] See also Second Ann. Rept. U. S. Reclamation Service, p. 358; Third Ann. Rept., p. 346.

Partial analyses, gage heights, and rates of discharge of water and solids for Truckee River at diversion dam near Derby, Nev.

[Drainage area, 1,750 square miles.]

Date.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1906–7.									
April 10	0	51	5	128	136	7.7	2,840	980	1,040
April 18	0	57	2	150	104	8.6	3,840	1,550	1,080
May 8	0	45	5	48	94	9.9	5,470	709	1,390
May 17	0	64	10	10	140	8.0	3,160	853	1,180
May 24	0	54	10	48	106	7.5	2,640	343	756
June 1	0	64	5	0	132	6.8	1,990	0	709
June 9	6	35	5	26	135	7.7	2,840	200	1,040
June 18	0	54	10	50	112	8.6	3,840	519	1,160
June 24	0	54	10	10	134	8.4	3,600	97	1,300
July 1	0	41	5	94	80	7.8	2,940	747	635
July 8	21	10	10	60	90	8.0	3,160	512	768
July 21	13	77	.....	28	116	6.0	1,410	107	442
July 28	16	48	5	86	150	6.0	1,410	328	572
August 5	13	82	10	30	160	4.7	675	55	292
August 10	0	102	10	30	172	4.6	625	51	290
August 20	0	98	15	0	184	4.7	675	0	335
August 27	0	123	15	16	160	4.8	725	31	313
September 3	0	104	12	0	124	4.8	725	0	243
September 16	0	102	12	16	152	4.9	775	33	318
September 24	0	100	8	54	118	4.9	775	113	247
October 2	0	99	7	18	134	4.3	490	24	177
October 10	0	92	9	50	128	4.7	675	91	233
October 22	0	86	11	64	120	5.0	825	142	268
October 29	0	96	13	98	116	4.5	580	153	182
November 5	0	91	29	0	176	5.8	1,280	0	608
November 12	0	86	12	8	156	5.2	930	20	392
November 20	0	126	13	52	144	5.0	825	116	321
November 26	0	84	14	24	118	5.0	825	53	263
December 5	0	98	25	56	124	4.9	775	117	259
December 19	0	86	17	8	162	5.2	930	20	407
January 1	0	82	19	14	134	5.3	985	37	357
January 10	0	103	22	32	146	5.3	985	85	389
January 15	0	95	19	28	138	4.9	775	59	289
January 29	0	74	21	80	214	6.7	1,910	413	1,100
February 6	0	55	12	54	82	7.6	2,740	400	607
February 14	0	67	12	46	122	6.2	1,540	191	507
February 24	0	72	10	6	100	6.2	1,540	25	416
March 3	0	84	16	8	142	5.9	1,340	29	514
March 13	0	86	21	34	130	5.8	1,280	117	449

NOTE.—Gaging station at Vista, Nev., drainage area 1,520 square miles, about 15 miles above the sampling station.

Relative amount of substances in solution in water from Truckee River at diversion dam near Derby, Nev.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1906-7.											
April 10–May 24	4	.....	106	14	4.6	23	0.00	64	.....	9.3	0.00
May 17–June 18	4	+14.0	112	15	5.2	23	.00	65	14	11	.06
June 24–July 21	4	.....	101	14	5.0	.....	.00	76	.....	4.0	.02
July 28–August 20	4	+12.9	151	13	5.2	19	.00	65	8.6	6.6	.00
August 27–September 24	4	.....	153	.....	5.7	19	.00	66	13	6.4	.06
October 2–29	4	+ 2.3	144	15	4.4	17	.00	64	21	10	.01
November 5–26	4	+ 2.9	174	12	5.6	20	.00	73	14	11	.00
December 5–January 1	3	+ 9.4	180	11	4.6	21	.00	49	14	14	.02
January 10–February 6	4	+12.6	160	13	4.1	19	.00	51	14	10	Tr.
February 14–March 13	4	+12.1	150	15	4.1	18	.00	49	19	8.7	Tr.
Mean	.....	9.5	143	14	4.8	20	.00	62	15	9.1	.02

Monthly discharge, in second-feet, of Truckee River at Vista, Nev.

Month.	1890.	1891.	1892.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	Mean.
January	.....	[a] 700	593	.....	547	661	389	653	572	894	871	1,060	694
February	.....	[a] 650	505	.....	428	1,490	598	624	1,780	943	797	1,620	944
March	.....	[a] 650	723	.....	857	1,330	589	1,080	3,430	1,240	1,210	[a]7,000	1,810
April	[b]4,500	1,520	854	.....	755	1,380	1,920	1,540	4,170	1,000	2,910	[a]6,500	2,460
May	5,990	2,760	937	.....	1,260	2,140	1,610	1,850	4,920	1,280	3,870	4,180	2,800
June	4,160	1,900	.....	.....	709	1,260	1,060	1,020	3,170	930	3,400	3,950	2,160
July	2,200	945	.....	.....	110	425	[a] 292	259	1,310	260	2,170	2,710	1,070
August	952	485	.....	114	122	315	311	192	771	224	729	1,640	532
September	682	558	.....	123	192	329	443	321	785	279	722	2,060	590
October	742	561	.....	378	429	477	485	486	1,050	430	763	2,130	721
November	765	503	.....	530	567	557	778	845	924	460	960	1,930	796
December	[a] 750	508	.....	456	561	510	[a] 650	569	844	421	952	1,860	735
The year	.....	980	.....	.....	544	906	758	786	1,980	697	1,610	3,070	1,280

[a] Approximate. [b] April 26–30.

TUOLUMNE RIVER NEAR LA GRANGE, CAL.

Samples of water were collected from Tuolumne River at a wagon bridge near La Grange, Cal., from October 7, 1905, to January 3, 1906. A gaging station was established by the United States Geological Survey near La Grange August 29, 1895. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for the station have been published by the Survey in the following reports:

Annual Reports: 18, IV, pp. 378–383; 19, IV, pp. 512–514; 20, IV, pp. 63, 532; 21, IV, pp. 449–450, 454; 22, IV, p. 465.

Bulletin 140, pp. 301–303.

Water-Supply Papers: 11, p. 90; 16, p. 188; 28, pp. 178–179, 183–186; 38, pp. 393–395; 39, p. 455; 66, pp. 149, 167, 178; 75, p. 214; 81, pp. 386–392; 85, pp. 142–145; 100, pp. 285–287; 134, pp. 156–158; 177, pp. 209–212; 213, pp. 165–169; 251, pp. 270–280.

Additional information in regard to the quality of the water of Tuolumne River is contained in Water-Supply Paper 237, "Quality of California surface waters," pages 51–53.

Partial analyses, gage heights, and rates of discharge of water and solids for Tuolumne River at wagon bridge near La Grange, Cal.

[Drainage area, 1,500 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet.)	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–6.									
October 5, 6, 7, 8, 9, 10, 11	0	61	10	6	130	3.6	36	1	13
October 12, 13, 14, 15, 16, 17, 19	0	58	9	30	98	3.5	33	3	9
October 18, 19, 20, 21, 22, 23, 24, 25	0	64	14	16	88	3.7	51	2	12
October 26, 27, 28, 29, 30, 31	0	62	11	66	86	3.7	51	9	12
November 1, 2, 3, 4	0	61	12	6	104	3.6	48	1	13
November 5, 6, 7, 8, 9, 10, 11	0	69	12	2	144	3.6	48	0	19
November 12, 13, 14, 15, 16, 17, 18	0	71	7	12	92	3.7	53	2	13
November 19, 20, 21, 22, 23, 25	0	83	18	10	146	3.8	64	2	25
November 24, 26, 27, 30, December 1, 2	0	69	18	6	116	3.9	103	2	32
December 3, 4, 5, 6, 7, 8, 9	0	63	10	58	96	4.0	120	19	31
December 10, 11, 12, 13, 18, 19, 20, 21, 22, 23	0	67	11	122	96	4.0	126	42	33
December 24, 26, 27, 28, 29, 30	0	56	11	40	98	4.1	144	16	38
December 31, January 1, 2, 3	0	59	11	56	170	4.1	158	24	72

Relative amount of substances in solution in water from Tuolumne River at wagon bridge near La Grange, Cal.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{1}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905.											
October 7, 31	28	+5.6	96	20	5.3	14	0.00	61	19	10	4.6
November 24, December 30	29	+10.7	110	18	5.4	17	.00	62	19	10	.08
Mean		8.2	103	19	5.4	15	.00	62	19	10	2.3

Monthly discharge, in second-feet, of Tuolumne River and Modesto and Turlock canals near La Grange, Cal.

Month.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.
January	.....	2,310	1,230	454	487	2,380	3,350	352
February	.....	1,160	5,170	900	740	1,030	7,200	1,440
March	.....	2,720	4,030	1,220	3,620	2,430	3,720	2,290
April	.....	3,520	7,740	4,010	5,190	2,480	3,960	5,000
May	.....	4,430	11,900	4,620	4,510	6,930	8,040	6,660
June	.....	7,690	5,670	2,250	6,660	5,360	9,390	6,920
July	.....	3,000	2,180	277	1,020	814	3,700	1,400
August	.....	485	237	85	200	100	784	378
September	263	432	86	20	52	37	175	91
October	134	120	222	52	512	1,230	211	113
November	113	1,140	768	39	2,430	2,540	574	676
December	270	1,080	1,100	256	3,050	1,330	1,340	809
The year	.....	2,340	3,360	1,180	2,320	2,160	3,540	2,180

Month.	1903.	1904.	1905.	1906.	1907.	1908.	Mean.
January	2,070	434	745	2,860	2,460	1,180	1,560
February	1,790	4,130	1,930	2,180	4,240	1,000	2,530
March	3,370	5,950	3,490	7,180	11,200	2,120	4,100
April	6,010	6,410	4,020	6,500	9,810	3,500	5,240
May	8,300	11,700	5,930	11,100	10,500	4,100	7,600
June	7,810	9,580	5,970	13,900	11,200	3,070	7,350
July	1,420	2,970	1,340	11,600	8,210	1,020	3,000
August	263	769	212	2,220	2,140	390	636
September	105	652	78	470	496	116	220
October	72	3,540	46	216	304	219	499
November	1,040	808	62	243	322	218	783
December	432	463	129	1,470	634	362	909
The year	2,720	3,950	2,000	4,990	5,130	1,440	2,870

NOTE.—No flow in Modesto canal until 1903. Not included in table is flow of La Grange Ditch and Hydraulic Mining Company's canal with following approximate discharge in second-feet: 1895, 35; 1896, 32; 1897–1899, 24; 1900, 20; 1901–1908, less than 10. The Tuolumne was gaged at Modesto, a short distance below La Grange, by the state engineer, from November, 1878, to October, 1884, and by the U. S. Geological Survey in 1895 and 1896. Monthly discharge for these periods is published in Water-Supply Paper 81, pp. 396–399; the monthly mean discharge is given below.

Monthly discharge, in second-feet, of Tuolumne River near Modesto, Cal.

Month.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1895.	1896..	Mean.
January	.....	478	409	2,880	620	654	410	4,830	3,080	1,670
February	.....	1,880	625	6,760	573	490	490	3,920	1,180	1,990
March	.....	2,800	832	2,880	2,160	1,310	6,540	3,160	2,720	2,800
April	.....	4,460	7,140	6,260	3,540	3,270	7,360	5,820	3,580	5,180
May	.....	5,090	10,400	7,270	7,460	8,180	7,360	11,800	5,180	7,840
June	.....	7,060	14,100	5,220	8,050	6,540	8,180	9,160	11,600	8,740
July	.....	1,980	7,620	2,000	2,740	1,640	6,540	3,830	4,120	3,810
August	.....	183	1,230	391	574	490	1,640	848	575	741
September	.....	39	134	125	255	327	327	615	574	300
October	.....	30	56	130	873	262	245	152	224	246
November	65	101	35	193	570	327	.....	255	1,210	344
December	65	903	1,100	620	327	327	.....	283	1,030	582
The year	.....	2,080	3,640	2,890	2,310	1,980	.....	3,720	2,930	2,850

TURKEY CREEK NEAR OLUSTEE, OKLA.

Samples of water were collected from Turkey Creek at Fullerton dam, near Olustee, Okla., from March 4, 1906, to February 19, 1907. A gaging station was established by the United States Geological

Survey at Olustee April 20, 1905. Stream-flow data, including gage heights and estimates of discharge, for the station have been published by the Survey in the following reports:

Water-Supply Papers: 173, pp. 94–95; 209, p. 69; 247, pp. 86–88.

Partial analyses and gage heights for Turkey Creek at Fullerton dam, near Olustee, Okla.

[Drainage area, 320 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle. (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).	
1906–7.						
March 4	0	150	600	60	4,280	2.3
March 13	0	140	590	.....	4,520	2.3
March 18	0	274	600	380	4,300	2.3
March 22	0	198	610	64	4,300	2.3
March 26	0	211	590	12	4,300	2.3
March 30	0	198	590	.....	4,600	2.3
April 2	0	192	610	20	4,280	2.3
April 5	0	76	29	948	412	15.7
April 9	0	192	310	12	2,650	2.8
April 16	0	236	484	36	3,670	2.4
April 19	0	242	542	0	4,090	2.5
April 24	0	242	590	60	4,220	2.4
April 26	0	287	561	124	4,110	2.3
April 30	0	96	29	1,930	224	12.0
May 7	0	204	271	360	2,720	2.7
May 9	0	262	426	232	3,580	2.7
May 14	0	211	494	196	3,860	2.6
May 17	0	96	87	220	1,180	2.7
May 20	0	223	387	88	3,300	2.6
May 24	0	102	97	128	880	6.0
May 28	0	179	242	192	2,350	2.7
June 1	0	211	406	148	3,470	2.6
June 4	0	96	87	132	1,120	2.8
June 6	0	121	106	216	1,260	2.7
June 11	0	198	325	144	3,680	2.6
June 18	0	147	382	80	2,510	2.6
June 21	0	121	148	116	1,600	2.5
June 25	0	185	366	80	3,170	2.8
June 28	0	108	89	124	1,400	2.5
July 2	0	178	404	100	3,460	2.5
July 5	0	178	446	84	3,710	2.5
July 9	0	170	485	28	3,860	2.5
July 13	0	85	79	0	1,090	2.6
July 16	0	85	69	28	1,060	4.2
July 20	0	137	356	68	2,210	3.0
July 23	0	124	138	28	1,510	2.7
July 26	0	176	386	108	3,330	2.5
July 30	0	92	20	308	492	6.4
August 11	0	98	40	948	688	7.6
August 14	0	262	386	80	3,370	2.7
August 22	0	216	507	20	3,940	2.6
August 25	0	223	455	148	3,700	2.6
September 4	0	105	150	568	1,240	5.8
September 7	0	116	107	60	1,180	2.7
September 10	0	157	244	28	2,360	2.6
September 12	0	203	410	148	3,240	2.6
September 15	0	86	51	864	892	4.6
September 18	0	62	23	1,040	344	10.6
September 19	0	87	34	556	480	10.6
September 22	0	204	216	88	2,210	2.7
September 25	0	235	512	356	3,940	2.6
October 2	0	211	451	400	3,770	2.6
October 7	0	225	475	40	3,840	2.6
October 12	0	205	494	176	4,050	2.6
October 16	0	79	39	84	588	9.0
October 22	0	266	403	136	3,630	2.8
October 29	0	242	448	415	4,020	2.7
November 3	0	246	465	384	3,880	2.7
November 7	0	237	448	240	3,600	2.8
November 9	0	225	524	148	3,940	2.7

Partial analyses and gage heights for Turkey Creek at Fullerton dam, near Olustee, Okla.—Continued.

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).
	Carbonate radicle (CO_3).	Cicar bonate radicle (HCO_3)	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).	
1906–7.						
November 19	0	250	485	200	4,040	2.7
November 23	0	261	507	0	3,860	2.7
November 26	0	255	540	108	3,970	3.1
November 30	0	62	102	292	1,280	6.2
December 2	0	129	88	360	1,040	8.4
December 5	9	200	320	204	2,960	3.3
December 12	0	229	454	212	3,880	2.9
December 14	0	224	470	224	3,870	2.9
December 19	0	215	501	336	3,970	2.8
December 22	0	215	485	360	3,740	2.8
December 27	0	200	496	88	4,010	2.8
December 31	0	215	501	64	3,980	2.8
January 3	0	220	501	124	3,900	2.8
January 6	0	191	516	112	3,910	2.8
January 9	0	57	41	456	708	7.6
January 12	0	210	434	112	3,650	3.7
January 15	0	210	485	136	3,860	3.2
January 20	0	229	434	436	3,760	7.6
January 22	0	182	506	280	4,040	3.2
January 24	0	258	423	128	3,760	3.1
January 30	0	248	437	336	3,770	3.0
February 4	0	229	454	72	3,900	2.9
February 8	0	248	454	20	3,940	2.9
February 11	0	281	516	96	3,920	2.9
February 15	0	200	516	20	4,040	2.8
February 19	0	190	516	12	3,980	2.8

Relative amount of substances in solution in water from Turkey Creek at Fullerton dam, near Olustee, Okla.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium (Na+K).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1906–7.											
March 4–June 28	29	+1.9	3,080	17	3.2	8.2	0.00	7.4	45	12	0.00
July 2–October 29	27	+1.4	2,580	16	3.3	8.5	.00	6.8	46	12	.00
November 3–February 19	29	.....	3,840	14	3.8	9.1	.00	4.1	.....	12	.01
Mean	.....	1.6	3,170	16	3.4	8.6	.00	6.1	46	12	T.

VERDE RIVER NEAR McDOWELL, ARIZ.

Samples of water were collected from Verde River at Mesa, near McDowell, Ariz., from April 5, 1905, to March 10, 1906. A gaging station was established by the United States Geological Survey near McDowell, Ariz., April 20, 1897. Stream-flow data, including gage

heights, rating tables, and estimates of discharge, for the station have been published by the Survey in the following reports:[a]

Annual Reports: 11, II, p. 100; 19, IV, pp. 420–423; 20, IV, pp. 59, 407; 21, IV, pp. 387–388.
Bulletin 131, pp. 49, 51.
Water-Supply Papers: 16, p. 150; 28, pp. 133, 141, 143; 38, pp. 323–324; 50, p. 387; 66, pp. 102–103; 73, pp. 13–16; 75, p. 177; 85, pp. 21–23; 100, pp. 31–36; 133, pp. 222–227; 175, pp. 181–185; 211, pp. 137–139; 249, pp. 191–195.

Information relative to the quality of Salt River at McDowell, below the mouth of Verde River, is contained in Bulletin 44 of the University of Arizona Agricultural Experiment Station, "The river irrigating waters of Arizona," by R. H. Forbes, 1902.

Partial analyses, gage heights, and rates of discharge of water and solids for Verde River at Mesa, near McDowell, Ariz.

[Drainage area, 6,000 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–6.									
April 5, 11, 14, 18, 20, 22	10	172	15	1,460	272	7.9	5,400	21,300	3,960
April 25, 26, 28, May 1, 3, 6	7	210	27	396	314	6.0	1,820	1,950	1,550
May 9, 12, 13, 15, 17, 19	19	203	25	200	316	5.4	1,100	594	938
May 23, 24, 26, 29, 31, June 2	13	242	39	26	420	4.3	397	28	451
June 5, 7, 9, 11, 13, 15, 17	24	182	41	38	422	4.0	320	33	365
June 20, 22, 24	7	255	53	56	416	3.8	234	35	263
June 28, 29, July 4, 6, 8	0	285	41	2	490	3.6	143	1	189
July 11, 15, 18, 20, 22	0	242	51	92	452	3.7	203	50	253
July 25, 27, 28, 29	36	185	.....	4,340	496	4.2	368	4,310	492
August 1, 3, 5	8	250	40	1,850	432	4.3	408	2,040	475
August 8, 10, 12, 16, 22, 24	0	236	26	5,000	378	4.5	530	7,160	541
August 29, 31, September 2, 5, 7, 9	18	179	28	6,860	328	5.1	954	17,700	845
September 12, 15, 19, 21, 23, 26, 30	0	284	37	2,940	410	4.9	1,110	8,820	1,230
October 4, 7, 10, 12, 14, 18, 19	20	242	33	304	414	4.2	386	317	432
October 21, 26, 28, 31, November 2, 4	9	267	30	170	326	4.0	313	144	276
November 7, 9, 11, 14, 16, 18	0	250	28	1,320	340	4.7	837	2,980	768
November 22, 24, December 2, 5, 8, 12, 15	0	234	25	266	306	4.6	1,070	768	884
December 19, 22, 26, 29, January 5, 6	11	262	30	12	404	3.6	520	17	567
January 9, 11, 13, 16, 23, 26	16	234	25	140	348	3.9	711	269	668
January 30, February 1, 3, 6, 13, 15, 17	0	236	21	198	288	5.1	723	387	562
February 19, 20, 21, 22, 23, 24	0	202	23	126	268	5.1	1,530	520	1,110
February 26, 27, 28, March 1, 2, 3	8	199	34	2	334	4.5	1,040	6	938
March 5, 6, 7, 8, 9, 10	6	223	29	50	326	4.1	655	88	576

[a] See also First Ann. Rept. U. S. Reclamation Service, p. 87.

Relative amount of substances in solution in water from Verde River at Mesa, near McDowell, Ariz.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905–6.											
April 5–June 2	24	+3.1	338	14	7.1	11	1.3	65	16	7.1	0.13
June 5–July 22	20	.....	438	16	7.5	14	1.4	.....	21	9.6	.07
July 25–September 9	19	.....	370	.....	6.5	[a] 14	.00	65	17	9.7	.06
September 12–November 18	26	.....	405	17	6.9	13	.00	70	22	.....	.02
November 22–February 17	26	−4.7	346	16	4.0	11	.00	72	16	11	.08
February 19–March 10	18	+8.0	297	19	7.4	12	2.4	71	15	8.4	.01
Mean	.....	5.3	366	16	6.6	12	.85	69	18	9.2	.06

[a] Sodium is 98 per cent and potassium is 2.4 per cent of this amount.

Monthly discharge, in second-feet, of Verde River near McDowell, Ariz.

Month.	1888.[a]	1889.[a]	1890.[a]	1891.[a]	1892.[a]	1893.[a]	1894.[a]	1895.[a]	1896.	1897.	1898.	1899.
January	.....	2,500	2,090	1,440	284	231	244	4,040	324	[a] 2,140	253	350
February	.....	1,170	4,540	17,500	[b] 192	672	259	1,690	154	[a] 873	496	344
March	.....	3,410	2,500	1,930	[b] 160	5,390	530	3,720	276	[a] 1,500	639	260
April	.....	795	368	534	[b] 88	290	171	750	220	[a] 1,190	319	205
May	.....	197	174	458	[b] 91	150	68	258	172	269	184	152
June	.....	141	153	401	[b] 52	68	79	153	117	150	139	152
July	.....	208	220	314	152	225	119	145	864	130	323	365
August	172	204	1,900	278	198	802	439	359	[a] 849	439	400	434
September	168	250	1,120	395	164	530	292	176	[a] 557	992	338	357
October	166	220	1,380	258	223	376	242	475	[a] 452	309	169	549
November	421	288	2,360	256	257	296	230	463	[a] 492	262	195	203
December	3,350	2,840	3,130	328	282	315	442	391	[a] 352	267	303	292
The year	.....	1,020	1,670	2,000	179	778	259	1,050	402	710	313	305

Month.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	Mean.	Mean, 1896–1908.
January	189	351	224	[b] 249	237	1,420	812	2,430	306	1,010	595
February	199	1,860	239	[b] 362	226	7,710	1,200	2,620	1,970	2,210	1,450
March	160	895	[b] 246	[b] 1,470	184	8,780	5,460	3,780	1,390	2,130	1,960
April	88	185	[b] 220	[b] 2,750	119	5,230	1,030	838	301	785	959
May	91	140	[b] 184	141	126	832	247	251	443	231	249
June	52	105	[b] 117	136	63	283	150	209	146	143	140
July	52	210	[b] 86	232	729	245	234	217	463	277	319
August	151	627	[b] 478	329	1,620	567	743	432	870	585	591
September	121	93	[b] 1,060	513	482	771	211	403	356	445	475
October	183	134	[b] 144	318	188	544	181	614	264	352	300
November	430	245	[b] 208	207	210	3,430	312	375	281	544	530
December	224	268	[b] 644	227	241	875	2,640	323	3,130	993	786
The year	161	426	321	578	369	2,560	1,100	1,040	827	809	696

[a] From Water-Supply Paper 73; obtained by taking proportional part of discharge of Salt River at Arizona dam.
[b] Approximate.

YELLOWSTONE RIVER NEAR BILLINGS, MONT.

Samples of water were collected from Yellowstone River at a county bridge near Billings, Mont., from May 20 to November 24, 1905. A gaging station was established by the United States Geological Survey near Billings May 29, 1904, and was discontinued December 31, 1905. A station was established at Junction May 10, 1906, and was discontinued December 31, 1907; and a station was then established at Huntley, Mont., January 1, 1907. The flow at the three stations is approximately the same. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for these stations have been published by the Survey in the following reports:

Water-Supply Papers: 130, pp. 120–122; 172, pp. 95–97; 208, pp. 88–90; 246, pp. 144–148.

Partial analyses, gage heights, and rates of discharge of water and solids for Yellowstone River at county bridge near Billings, Mont.

[Drainage area, 11,180 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905.									
May 20, 24, June 7, 11, 12, 13, 14	7	92	35	914	238	7.6	21,800	53,800	14,000
June 15, 18, 19, 20, 21, 22	0	87	11	216	148	7.9	21,700	12,700	8,660
July 5, 6, 7, 8	0	74	7	1,110	138	7.6	20,100	60,000	7,490
July 9, 11, 12, 13, 15	0	69	6	64	164	6.6	16,000	2,770	7,090
July 26, August 1, 2, 3	0	102	12	258	192	4.3	8,600	6,000	4,460
August 6, 7, 9, 10, 15	0	120	8	114	236	3.7	7,100	2,190	4,530
August 21, 27, 28, 29, 30, 31, September 1	0	110	17	10	230	2.7	4,770	129	2,960
September 1, 2, 3, 4, 5, 6	0	105	16	66	184	2.6	4,570	815	2,270
September 10, 11, 12, 13, 14, 18, 19	0	118	20	10	260	2.2	3,820	103	2,680
September 21, 22, 23, 26, 27, 29, 30	0	133	15	38	300	2.1	3,660	376	2,970
October 1, 2, 3, 5, 6, 11	0	135	18	102	320	2.2	3,810	1,050	3,290
October 12, 13, 14, November 13, 14, 15, 16	11	120	20	182	354	2.0	3,360	1,650	3,210
November 18, 19, 20, 21, 22, 23, 24	0	144	18	46	336	1.9	3,160	393	2,870

Relative amount of substances in solution in water from Yellowstone River at county bridge near Billings, Mont.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{5}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905.											
July 26–September 19	24	−3.7	231	15	2.0	14	0.00	49	32	5.6	0.08
September 21–November 24	27	.....	325	12	5.5	13	.00	46	.....	5.5	.06
Mean	.....	3.7	278	14	3.8	13	.00	48	32	5.6	.07

Monthly discharge, in second-feet, of Yellowstone River near Billings, Mont.

Month.	1904.[a]	1905.[a]	1906.[b]	1907.[b]	1908.[c]	Mean.
January	.....	.....	.....	[d] 1,560	[c] 2,790	2,180
February	.....	.....	.....	[d] 4,500	1,870	3,180
March	.....	[e] 2,610	.....	[f] 3,140	1,880	2,540
April	.....	2,750	.....	4,000	4,470	3,740
May	.....	5,940	[g] 16,400	9,800	12,700	11,200
June	26,000	24,700	20,100	27,800	31,500	26,000
July	18,100	14,700	14,600	34,400	23,400	21,000
August	8,260	6,220	7,060	13,200	9,070	8,760
September	5,240	3,930	4,520	6,630	5,450	5,150
October	3,970	3,620	3,140	4,930	5,420	4,210
November	3,420	3,290	2,770	3,650	4,140	3,450
December	2,910	.....	2,810	3,040	2,940	2,920
The year	.....	.....	.....	9,720	8,800	7,860

[a] Billings; drainage area, 11,180 square miles.
[b] Junction; drainage area, 13,500 square miles.
[c] Huntley; drainage area, 12,000 square miles.
[d] Estimated.
[e] March 12–31.
[f] March 19–31.
[g] May 10–31.

YELLOWSTONE RIVER NEAR GLENDIVE, MONT.

Samples of water were collected from Yellowstone River at a highway bridge near Glendive, Mont., from March 28, 1905, to April 21, 1906. A gaging station was established near Glendive in 1893, and gage heights recorded by the United States Weather Bureau. The records of the United States Geological Survey begin August 1, 1903. Stream-flow data, including gage heights, rating tables, and estimates of discharge for the station have been published by the Survey in the following reports:

Water-Supply Papers: 99, pp. 91–97; 130, pp. 123–126; 172, pp. 97–100; 208, pp. 90–92; 246, pp. 149–150.

Partial analyses, gage heights and rates of discharge of water and solids for Yellowstone River at highway bridge near Glendive, Mont.

[Drainage area, 66,100 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905–6.									
March 28 [a]	.....	.....	.....	94	548	0.7	4,310	1,090	6,380
March 28 [b]	.....	.....	.....	86	564	0.7	4,310	1,000	6,560
April 2, 3, 4, 5, 6	11	159	21	76	484	0.6	4,040	830	5,290
April 9, 10, 11, 12, 13	0	175	18	4	504	0.4	3,780	41	5,150
April 28, 29, 30, May 1, 2, 3, 6	0	170	19	868	440	1.1	5,180	12,100	6,150
May 4, 5, 7, 8	0	154	15	1,920	384	1.6	6,470	33,600	6,710
July 4, 5, 7, 8	0	105	217	1,200	190	7.4	43,300	141,000	22,200
July 9, 10, 11, 14, 15	0	88	11	616	238	6.2	30,100	50,100	19,400
July 17, 18, 19, 20, 21, 22	0	88	8	960	188	5.4	23,200	60,100	11,800
July 23, 24, 25, 26, 27, 28, 29	0	29	5	2,210	.....	4.6	17,900	107,000	.....
July 30, 31, August 1, 2, 3, 4, 5	0	107	10	4,840	274	4.5	19,400	254,000	14,400
August 6, 7, 8, 9, 10, 11, 12	0	115	20	1,360	248	3.4	12,000	44,200	8,040
August 13, 14, 15, 16, 17, 18, 19	0	108	15	684	260	3.0	10,400	19,200	7,300
August 20, 21, 22, 23, 24, 25, 26	0	120	14	522	238	2.4	8,600	12,100	5,530
August 22	.....	.....	.....	430	302	2.7	9,450	11,000	7,700
August 27, 28, 29, September 1, 2	0	121	11	90	278	1.8	6,850	1,670	5,150
September 4, 5, 6, 7, 8, 9	0	129	20	730	312	1.8	6,830	13,500	5,750
September 10, 11, 12, 13, 14, 15, 16	10	106	14	126	264	1.5	6,100	2,070	4,350
September 18, 19, 20, 21, 22, 23, 26	0	141	15	148	308	1.1	5,050	2,020	4,200
September 25, 27, 28, 29, 30, October 1	0	146	13	1,910	348	1.0	5,000	25,700	4,700
October 2, 3, 4, 5, 6, 9	7	142	28	3,920	406	1.8	6,720	71,100	7,360
October 10, 11, 12, 13, 14, 15, 16	0	149	21	1,630	410	1.2	5,270	23,300	5,850
October 13	.....	.....	.....	868	374	1.1	5,200	12,200	5,250
October 17, 18, 19, 20, 21, 22, 23	7	148	17	190	444	1.4	5,830	2,990	7,000
October 24, 25, 26, 27, 28	0	163	16	268	428	1.4	5,760	4,170	6,660
October 29, 30, 31, November 1, 2	6	161	20	56	446	1.4	5,760	871	6,940
November 5, 6, 7, 8, 9, 10, 11	0	175	18	92	426	1.2	5,400	1,340	6,210
November 12, 13, 14, 15, 16, 17, 18	0	180	20	74	424	1.2	5,240	1,050	6,000
November 19, 20, 21, 22, 23, 25	5	168	16	58	476	1.1	5,100	799	6,550
April 4, 5, 6, 7, 8, 9	0	142	29	504	406	3.3	12,000	16,300	13,200
April 10, 11, 12, 13, 14	0	166	20	1,120	530	2.5	8,930	26,900	12,800
April 15, 16, 17, 18, 19, 20, 21	0	166	10	582	478	2.2	7,780	12,200	10,000

[a] Station 200; depth, 2.3 feet. [b] Station 440; depth, 4.8 feet.

Relative amount of substances in solution in water from Yellowstone River at highway bridge near Glendive, Mont.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium (Na+K).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905–6.											
April 2–May 8	21	+2.4	466	14	5.4	12	1.3	37	39	3.6	0.01
July 4–29	22	.....	198	16	4.9	15	.00	52	.....	7.1	.04
July 30–August 26	28	+4.5	263	17	3.7	[a] 14	.00	43	38	3.8	.08
September 25–October 23	27	+6.2	396	16	4.5	15	.00	36	42	4.5	.05
October 24–November 18	24	+2.3	445	15	5.4	13	.00	38	40	7.2	.02
April 4–21	18	.....	448	15	.....	12	.00	28	46	.....	.....
Mean	.....	3.8	369	15	4.8	14	.22	39	41	5.2	.04

[a] Sodium is 95 per cent and potassium is 7.1 per cent of this amount.

Monthly discharge, in second-feet, of Yellowstone River near Glendive, Mont.

Month.	1903.	1904.	1905.	1906.	1907.	1908.	Mean.
January	.....	[a] 5,700	.....	.....	.....	.....	[a] 5,700
February	.....	[a] 5,700	.....	.....	.....	.....	[a] 5,700
March	[b] 17,600	[a] 5,700	[c] 4,670	.....	[d] 9,680	.....	[e] 7,760
April	6,210	13,900	4,370	10,700	6,940	[e] 8,440	8,430
May	10,800	27,000	9,670	25,100	20,600	21,300	19,100
June	40,600	54,900	48,000	41,500	53,200	60,800	49,800
July	28,100	33,500	29,200	26,300	64,000	44,800	37,600
August	14,000	12,700	11,100	15,400	24,100	16,400	15,600
September	7,740	8,270	5,750	8,820	11,600	8,620	8,470
October	6,860	.....	5,920	5,610	8,220	9,500	7,220
November	[a] 5,750	.....	5,920	5,570	6,100	[f] 7,710	6,080
December	[a] 5,700	[g] 7,710	.....	.....	[h] 5,380	.....	[e] 6,000
The year	.....	.....	.....	.....	.....	.....	[e] 14,800

[a] Estimated. [b] March 16–31. [c] March 20–31. [d] March 24–31. [e] Approximate. [f] November 1–10. [g] December 1–5. [h] December 1–12.

YUBA RIVER NEAR SMARTSVILLE, CAL.

Samples of water were collected from Yuba River at the narrows near Smartsville, Cal., from July 7 to September 7, 1905. A gaging station was established by the United States Geological Survey near Smartsville, June 2, 1903. Stream-flow data, including gage heights, rating tables, and estimates of discharge, for the station have been published by the Survey in the following reports:

Annual Report 22, IV, p. 463.

Water-Supply Papers: 51, pp. 452–453; 85, p. 157; 100, pp. 270–272; 134, pp. 140–143; 177, pp. 160–164; 213, pp. 141–143; 251, pp. 213–216.

Additional information in regard to the quality of the water of Yuba River is contained in Water-Supply Paper 237, "Quality of California surface waters," pages 38–41.

Partial analyses, gage heights, and rates of discharge of water and solids for Yuba River at the narrows near Smartsville, Cal.

[Drainage area, 1,220 square miles.]

Dates.	Analysis (milligrams per liter).					Mean gage height (feet).	Mean discharge (second-feet).	Solids (tons per day).	
	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Chlorine radicle (Cl).	Suspended matter (Sm).	Dissolved solids (Ds).			Suspended matter.	Dissolved solids.
1905.									
July 7	.....	.....	.....	60	134	2.4	980	159	355
July 7, 8, 9, 10, 11, 12, 13, 14, 15	0	72	7	76	96	2.2	845	174	219
July 20	.....	.....	.....	0	218	2.0	710	0	417
July 21, 22, 24, 25, 26, 27, 28, 29	6.1	74	7	26	118	1.8	585	41	186
August 7, 8, 9, 10, 11, 12	0	74	12	18	96	1.5	480	23	124
August 14, 15, 16, 17, 18, 19	0	78	12	112	118	1.4	459	139	146
August 21, 22, 23, 24, 25, 26	0	74	2	106	112	1.4	459	131	139
August 28, 29, 30, 31, September 1, 2	0	81	8	124	126	1.3	435	146	148
September 4, 5, 6, 7	0	88	8	88	152	1.3	435	103	178

Relative amount of substances in solution in water from Yuba River at the narrows near Smartsville, Cal.

Limiting dates of composite.	Number of daily samples.	Errors.	Dissolved solids (Ds) (milligrams per liter).	Radicles in per cent of dissolved solids.							
				Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate (CO_3).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).
1905.											
July 7, August 19	29	−0.5	123	15	3.7	[a] 15	6.2	58	19	5.7	0.11
August 21, September 7	16	+8.8	152	18	4.3	14	.00	57	22	6.0	.06
Mean		4.6	138	16	4.0	14	3.1	58	20	5.8	.08

[a] Sodium is 87 per cent and potassium is 18 per cent of this amount.

Monthly discharge, in second-feet, of Yuba River near Smartsville, Cal.

Month.	1900.	1903.	1904.	1905.	1906.	1907.	1908.	Mean.
January			1,920	4,900	7,560	4,990	3,380	4,550
February			14,900	5,010	4,970	14,100	2,230	8,240
March			15,400	7,110	12,000	17,300	3,590	11,100
April			10,600	6,750	8,770	13,100	4,800	8,800
May			10,600	6,070	10,800	8,750	5,200	8,280
June		2,910	4,650	3,100	10,000	6,750	3,180	5,100
July	724	899	1,160	782	3,350	3,060	705	1,530
August	480	516	580	471	744	736	350	554
September	458	479	637	429	520	505	329	480
October	[a] 1,540	550	1,860	453	403	517	521	835
November		4,890	1,180	474	757	472	478	1,380
December		2,010	2,280	566	4,130	1,590	764	1,890
The year			5,480	3,010	5,330	5,990	2,130	4,390

[a] October 1–13.

SUMMARY.

The following table presents a summary of the analyses given in detail in the foregoing pages:

Summary of results of mineral analyses of surface waters of western United States.

Source (river unless otherwise stated) and location.	Dissolved solids (Ds) (milligrams per liter).	Radicles in milligrams per liter. [a]							Radicles in per cent of dissolved solids.							Reacting values of radicles. [c]							
		Calcium (Ca).	Magnesium (Mg).	Sodium and potassium (Na+$\frac{3}{4}$K).	Bicarbonate (HCO_3).[b]	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).	Calcium (Ca).	Magnesium (Mg).	Sodium and potassium (Na+$\frac{3}{4}$K).	Bicarbonate (HCO_3).[b]	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).	Calcium (Ca).	Magnesium (Mg).	Sodium and potassium (Na+$\frac{3}{4}$K).	Bicarbonate (HCO_3).[b]	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).	Apparent error (per cent).
American, Fairoaks, Cal	125	12	4.7	22	58	16	12	0.22	10	3.8	18	46	13	10	0.18	0.60	0.39	0.96	0.95	0.33	0.34	0.004	+ 9
Animas, Durango, Colo	324	71	12	25	150	110	23	.19	22	3.8	7.6	46	33	7.1	.06	3.54	.99	1.09	2.46	2.29	.65	.003	+ 2
Belle Fourche, Bellefourche, S. Dak	844	130	37	57	180	420	19	.25	15	4.4	6.8	22	50	2.3	.03	6.48	3.04	2.48	2.95	8.75	.54	.004	— 1
Belle Fourche, diversion dam, Bellefourche, S. Dak	938	180	47	41	210	470	13	.66	19	5.0	4.4	22	50	1.4	.07	8.98	3.87	1.78	3.44	9.79	.37	.011	+ 4
Bighorn, Fort Custer, Mont	396	63	21	44	170	150	20	.12	16	5.2	11	43	37	5.1	.03	3.14	1.73	1.91	2.79	3.12	.56	.002	+ 2
Boise, Boise, Idaho	97	18	4.0	16	62	14	6.8	.10	19	4.1	17	64	14	7.0	.10	.90	.33	.70	1.02	.29	.19	.002	+12
Carson, Hazen, Nev	199	32	8.6	30	100	50	12	.10	16	4.3	15	51	25	6.2	.05	1.60	.71	1.30	1.64	1.05	.34	.002	+ 9
Colorado, Yuma, Ariz	707	92	23	110	230	180	130	.71	13	3.3	16	33	26	18	.10	4.59	1.89	4.78	3.77	3.75	3.67	.011	0
Elm Fork Red, Mangum, Okla	9,130	770	160	2,100	160	1,900	3,500	Tr.	8.4	1.7	23	1.7	21	38	Tr.	38.4	13.2	91.3	2.62	39.6	98.7	Tr.	+ 1
Feather, Oroville, Cal	109	19	7.4	15	80	14	11	.11	17	6.8	14	73	13	9.8	.10	.95	.61	.65	1.31	.29	.31	.002	+ 7
Gallinas, Las Vegas, N. Mex	204	41	5.9	29	150	24	22	.12	20	2.9	14	73	12	11	.06	2.04	.49	1.26	2.46	.50	.62	.002	+ 3
Gila, San Carlos, Ariz	736	81	22	150	260	88	220	.22	11	3.0	20	35	12	30	.03	4.04	1.81	6.52	4.26	1.83	6.21	.004	+ 1
Grand, Kremmling, Colo	124	26	6.7	16	89	26	9.3	.10	21	5.4	13	72	21	7.5	.08	1.30	.55	.70	1.46	.54	.26	.002	+ 6
Grand, Palisade, Colo	410	62	17	66	160	94	82	.12	15	4.1	16	40	23	20	.03	3.09	1.40	2.87	2.62	1.96	2.32	.002	+ 3
Green, Green River, Wyo	244	41	13	32	140	81	15	.12	17	5.3	13	58	33	6.0	.05	2.04	1.07	1.39	2.30	1.68	.42	.002	+ 1
Green, Jensen, Utah	344	55	17	45	180	100	32	.14	16	4.9	13	51	29	9.3	.04	2.74	1.40	1.96	2.95	2.08	.90	.002	+ 1
Gunnison, Whitewater, Colo	508	76	24	51	190	210	24	.71	15	4.8	10	38	41	4.8	.14	3.79	1.97	2.22	3.12	4.37	.58	.011	— 1
Hondo, Roswell, N. Mex	782	150	30	39	150	350	39	1.2	19	3.9	5.0	19	45	5.0	.15	7.48	2.47	1.70	2.46	7.29	1.10	.019	— 3
Link, Klamath Falls, Oreg	111	12	6.0	21	71	10	11	.48	11	5.4	19	64	9.4	9.7	.43	.60	.49	.92	1.16	.21	.31	.008	+ 9
Little Colorado, Holbrook, Ariz	845				271		187					32		22					4.44		5.27		
Little Colorado, Woodruff, Ariz	571	68	17	110	200	170	97	.11	12	2.9	19	35	30	17	.02	3.39	1.40	4.78	3.28	3.54	2.74	.002	0
Malheur, Vale, Oreg	316	35	14	51	200	54	25	.09	11	4.4	16	63	17	7.9	.03	1.75	1.15	2.22	3.28	1.12	.71	.001	0
Milk, Havre, Mont	604	47	29	120	360	180	20	.97	7.8	4.8	20	60	30	3.3	.16	2.34	2.39	5.22	5.90	3.75	.56	.016	— 1

[a] Calculated from dissolved solids in milligrams per liter and radicles in per cent of dissolved solids.
[b] Including carbonates calculated as HCO_3.
[c] See pp. 11-12.

Summary of results of mineral analyses of surface waters of western United States—Continued.

Source (river unless otherwise stated) and location.	Dissolved solids (Ds) (milligrams per liter).	Radicles in milligrams per liter.							Radicles in per cent of dissolved solids.							Reacting values of radicles.							
		Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).	Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).	Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Bicarbonate (HCO_3).	Sulphate (SO_4).	Chlorine (Cl).	Nitrate (NO_3).	Apparent error (per cent).
Missouri, Williston, N. Dak.	305	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
North Fork Red, Granite, Okla.	1,490	180	58	210	190	540	280	0.15	12	3.9	14	13	36	19	0.01	8.98	4.77	9.13	3.12	11.2	7.90	0.002	+ 1
North Fork Red, Headrick, Okla.	3,590	360	79	720	190	930	1,200	.14	10	2.2	20	5.3	26	33	.004	18.0	6.50	31.3	3.12	19.4	33.9	.002	− 1
North Platte, Fort Laramie, Wyo.	403	69	18	40	150	150	19	.08	17	4.4	10	38	37	4.8	.02	3.44	1.48	1.74	2.46	3.12	.54	.001	+ 4
Owens, Round Valley, Cal.	253	24	6.3	56	140	25	30	.05	9.5	2.5	22	56	10	12	.02	1.20	.52	2.43	2.30	.52	.85	.001	+ 6
Owens, Tinemaha, Cal.	371	33	10	90	206	44	46	.02	9.0	2.7	24	56	12	12	Tr.	1.65	.82	3.91	3.38	.92	1.30	Tr.	+ 6
Palouse, Hooper, Wash.	170	25	9.7	25	130	27	9.3	.22	15	5.7	15	74	16	5.5	.13	1.25	.80	1.09	2.13	.56	.26	.004	+ 3
Payette, Horseshoe Bend, Idaho	87	14	4.3	14	47	12	9.6	Tr.	16	4.9	16	54	14	11	Tr.	.70	.35	.61	.77	.25	.27	Tr.	+12
Pecos, Carlsbad, N. Mex.	2,720	380	95	300	160	1,200	460	.03	14	3.5	11	5.7	44	17	.001	19.0	7.81	13.0	2.62	25.0	13.0	Tr.	− 1
Pecos, Dayton, N. Mex.	3,110	440	100	400	170	1,200	620	.06	14	3.2	13	5.4	40	20	.002	22.0	8.23	17.4	2.79	25.0	17.5	.001	+ 2
Pecos, Santa Rosa, N. Mex.	1,220	270	37	45	180	620	43	.28	22	3.0	3.7	15	51	3.5	.023	13.5	3.04	1.96	2.95	12.9	1.21	.005	+ 4
Pit, Bieber, Cal.	191	25	9.4	32	130	19	16	.36	13	4.9	17	70	10	8.5	.19	1.25	.77	1.39	2.13	.40	.45	.006	+ 7
Puta Creek, Winters, Cal.	317	32	41	32	270	38	27	.13	10	13	10	85	12	8.5	.04	1.60	3.37	1.39	4.43	.79	.76	.002	+ 3
Redwater, Belle Fourche, S. Dak.	759	150	43	21	210	380	17	.15	20	5.6	2.8	27	50	2.3	.02	7.48	3.54	.91	3.44	7.92	.48	.002	0
Rio Grande, El Paso, Tex.	699	100	18	110	240	210	100	.49	15	2.6	16	34	30	15	.07	4.99	1.48	4.78	3.94	4.37	2.82	.008	0
Rio Grande, San Marcial, N. Mex.	438	70	14	61	170	140	41	.31	16	3.1	14	38	31	9.3	.07	3.49	1.15	2.65	2.79	2.92	1.16	.005	+ 3
Sacramento, Red Bluff, Cal.	125	16	7.4	16	78	16	12	.09	13	5.9	13	62	13	9.7	.07	.80	.61	.70	1.28	.33	.34	.001	+ 4
Sacramento, Sacramento, Cal.	122	20	7.8	21	82	20	13	.16	16	6.4	17	67	16	11	.13	1.00	.64	.91	1.34	.42	.37	.002	+ 9
Salmon Creek, Malott, Wash.	194	41	8.9	21	110	48	11	.10	21	4.6	11	56	25	5.7	.05	2.04	.73	.91	1.80	1.00	.31	.002	+ 8
Salt, Roosevelt, Ariz.	534	59	18	110	190	52	160	.11	11	3.3	21	36	9.8	30	.02	2.94	1.48	4.78	3.12	1.08	4.51	.002	+ 3
Salt Fork Red, Mangum, Okla.	2,300	410	92	160	140	1,200	220	.05	18	4.0	6.9	6.2	52	9.5	.002	20.4	7.57	6.96	2.30	25.0	6.21	.001	+ 2
San Francisco, Alma, N. Mex.	244	44	10	29	170	24	22	1.4	18	4.3	12	71	9.7	9.2	.57	2.20	.82	1.26	2.79	.50	.62	.023	+ 4
Sapello, Los Alamos, N. Mex.	269	62	11	26	190	59	13	.27	23	4.0	9.6	71	22	4.9	.10	3.09	.90	1.13	3.12	1.23	.37	.004	+ 4
Shoshone, Cody, Wyo.	153	23	6.7	29	87	35	11	.12	15	4.4	19	57	23	7.2	.08	1.15	.55	1.26	1.43	.73	.31	.002	+ 9
Stony Creek, Fruto, Cal.	326	39	20	33	210	55	23	.03	12	6.1	10	63	17	7.1	.01	1.95	1.65	1.42	3.44	1.15	.65	Tr.	− 2
Truckee, Derby, Nev.	143	20	6.9	29	89	21	13	.03	14	4.8	20	62	15	9.1	.02	1.00	.56	1.13	1.46	.44	.37	Tr.	+ 8
Tuolumne, La Grange, Cal.	103	20	5.6	15	64	20	10	2.4	19	5.4	15	62	19	10	2.3	1.00	.46	.65	1.05	.42	.28	.039	+ 9
Turkey Creek, Olustee, Okla.	3,170	510	110	270	190	1,500	380	Tr.	16	3.4	8.6	6.1	46	12	Tr.	25.4	9.05	11.7	3.12	31.2	10.7	Tr.	+ 1
Verde, McDowell, Ariz.	366	59	24	44	260	66	34	.22	16	6.6	12	70	18	9.2	.06	2.94	1.97	1.91	4.26	1.37	.96	.004	+ 2
Yellowstone, Billings, Mont.	278	39	11	36	130	89	16	.19	14	3.8	13	48	32	5.6	.07	1.95	.90	1.57	2.13	1.87	.45	.003	0
Yellowstone, Glendive, Mont.	369	55	18	52	140	150	19	.15	15	4.8	14	39	41	5.2	.04	2.74	1.48	2.26	2.30	3.12	.54	.002	+ 4
Yuba, Smartsville, Cal.	138	22	5.5	19	88	28	8.0	.11	16	4.0	14	64	20	5.8	.08	1.10	.45	.83	1.45	.58	.23	.002	+ 3

MISCELLANEOUS ANALYSES.

In addition to the series of analyses of stream waters, analyses of waters from streams, lakes, springs, wells, and borings were made from time to time at the Berkeley laboratory. These analyses are included under appropriate headings in the tables following.

Miscellaneous stream analyses.

State.	Location.	Stream.	Date.	Analysis (milligrams per liter).								Suspended matter (tons per day).	Dissolved solids (tons per day).	Gage height (feet).	Discharge (second-feet).
				Calcium radicle (Ca).	Magnesium radicle (Mg).	Sodium and potassium radicles ($Na+\frac{3}{4}K$).	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Sulphate radicle (SO_4).	Chlorine radicle (Cl).	Nitrate radicle (NO_3).				
California	Gibraltar gaging station	Santa Ynez River	July 31, 1905				0	285	247	28	0		605	2.00	3
Colorado	Keenan's camp near Montrose.	Dry Creek	Oct. 18, 1904				0	175		14			250		
Do	Hesperus gaging station	La Plata River	Summer, 1905									42	86		
Do	Maybell gaging station	Little Snake River	June 24, 1905									228	164	3.50	1,480
Do	Buford gaging station	Marvine Creek	July 7, 1905									0	210	2.10	146
Do	Meeker gaging station	White River	July 14, 1905									46	332	4.00	620
Do	Craig gaging station	Yampa River	July 25, 1905									6	174	2.70	445
Do	Maybell gaging station	do	June 26, 1905									30	142	3.90	4,090
Do	Steamboat Springs gaging station.	do	July 26, 1905									4	138	4.25	128
Idaho	Chilly gaging station	Big Lost River	Sept. 22, 1905									64	112	1.65	124
Do	Mackay gaging station	do	May 15, 1905									2	218	2.45	124
Do	do	do	June 10, 1905									26	172	5.15	987
Do	do	do	July 12, 1905									0	254	4.10	629
Do	do	do	Sept. 21, 1905									80	188	2.65	156
Do	Gimlet gaging station	Big Wood River	May 22, 1905									4	168		
Do	Presto gaging station	Blackfoot River	May 19, 1905									62	304	1.50	277
Do	do	do	June 8, 1905									0	312	1.00	205
Do	do	do	July 9, 1905									0	222	.30	95
Do	Fremont gaging station	Fall River	May 11, 1905									50	100	2.65	1,060
Do	do	do	Aug. 29, 1905									92	150	1.88	384
Do	Carey gaging station	Little Wood River	May 23, 1905									18	168	1.65	184
Do	Ora gaging station	North Fork Snake River	May 10, 1905									84	106	2.55	1,650
Do	do	do	Aug. 29, 1905									88	96	2.05	1,050
Do	do	do	Sept. 18, 1905									34	154	2.05	1,020
Do	Montgomerys Ferry gaging station.	Snake River	May 20, 1905									10	362	3.90	8,140
Do	do	do	June 6, 1905									188	190	5.15	12,200
Do	do	do	July 16, 1905									86	288	2.40	4,090
Do	do	do	Sept. 27, 1905									80	272	1.25	2,010
Do	Starrs Ferry	do	Apr. 25, 1905				15	165	58	21	0		362		
Do	Lyon gaging station	South Fork Snake River	May 14, 1905									64	318	2.60	5,070

Do	do	do	July 14, 1905										42	194	3.70	7,840
Do	do	do	Sept. 9, 1905										0	302	1.50	2,990
Do	St. Anthony gaging station	Teton River	May 12, 1905										52	140	1.95	648
Do	do	do	June 14, 1905										104	98	3.10	1,500
Do	do	do	Aug. 28, 1905										82	148	1.70	478
Montana	30 miles below Glendive	Yellowstone River	June 11, 1905				0	118		7				440		
New Mexico	Avalon reservoir	Pecos River	Feb. 28, 1905				0	172		963				4,110		
Do	do	do	Feb. 28, 1905				0	156		984				4,350		
Oklahoma	6 miles from Olustee	Bitter Creek	Dec. 12, 1905				0	263		637				3,350		
Do	Above Salt Springs	Elm Fork Red River	Oct. 17, 1905				0	141	1,950	2,690				7,530		
Do	do	Upper Salt Draw	do				0	7	3,570	182,000				317,000		
Do	do	Middle Salt Draw	do				0	15	3,360	110,000				184,000		
Do	do	Lower Salt Draw	do				0	10	3,890	193,000				331,000		
Do	Below Salt Springs	Elm Fork Red River	do				13	114	2,140	14,900				27,800		
Do	At mouth, left bank	do	Dec. 17, 1905				0	166		3,400				7,770		
Do	do	do	do				0	162		2,630				7,850		
Do	do	do	do				0	181		4,280				7,740		
Do	Mangum railroad bridge	do	Dec. 18, 1905				0	152		5,360				11,700		
Do	Mangum gaging station, center.	do	do				0	134		5,250				11,600		
Do	Mangum gaging station, right bank.	do	do				6	126		5,230				11,500		
Do	1 mile below Mangum	do	do				6	132		5,380				11,700		
Do	4 miles below Mangum, left bank.	do	do				14	124		5,550				12,000		
Do	At mouth of Elm Fork, right bank.	North Fork Red River	Dec. 17, 1905				0	221		289				1,490		
Do	do	do	do				0	225		322				1,410		
Do	do	do	do				0	223		280				1,410		
Do	Navajo pumping station	do	Feb., 1906				0	221		1,870		23,000		4,770		
Do	do	do	do				0	968		257		34,400		1,670		
Do	do	do	do				0	355		2,300		1,200		6,600		
Do	do	do	do				23	170		2,470		3,120		6,120		
Do	2 miles above Mangum	Salt Fork Red River	Dec., 1905				0	172		206				2,120		
Do	do	do	do				0	175		208				2,100		
Do	do	Stinking Creek	Dec. 16, 1905				0	282		1,080				4,660		
Do	do	do	do				0	285		1,110				4,750		
Do	Near Olustee	Turkey Creek	Dec. 19, 1905				0	210		389				3,260		
Do	do	do	do				0	205		389				3,230		
Oregon	Near Summer Lake	Ana River	July 28, 1905	10	5	58	14	89	37	19	0			214		
Do	SE. ¼ sec. 4, T. 19 S., R. 44 E., W. M.	Bully Creek	Mar., 1905	67	24		0	284	64	33				440		
Do	A. Eglis, Wagontire Mountain	Creek [a]	Dec., 1906	13	5	14	0	88	2	12	0			100		
Do	McDonald gaging station	John Day River	June 1, 1905	40	14	30	0	211	14	14	0			267	3.58	2,480
Do	do	do	Oct. 26, 1905	30	12	[b] 23	0	161	24	14	0			187	1.75	350
Do	NW. ¼ sec. 3, T. 19 S., R. 43 E., W. M.	Malheur River	Mar., 1905	31	17		0	156	58	157				536		
Do	2 miles north of Ontario	do	do	57	25		0	130	38	27				284		
Do	Near Ontario (Malheur River water).	Nevada ditch	do	33	13		0	143	71	14				262		

[a] Published in Water-Supply Paper 220, p. 72.

[b] Sodium, 18; potassium, 7.2.

Miscellaneous stream analyses—Continued.

State.	Location.	Stream.	Date.	Analysis (miligrams per liter).								Suspended matter (tons per day).	Dissolved solids (tons per day.)	Gage height (feet).	Discharge (second-feet).
				Calcium radicle (Ca).	Magnesium radicle (Mg).	Sodium and potassium radicles ($Na+\frac{3}{4}K$).	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Sulphate radicle (SO_4).	Chlorine radicle (Cl).	Nitrate radicle (NO_3).				
Oregon	1 mile north of Ontario	Snake River	Mar., 1905	40	19	.....	0	149	28	26	.....	.....	260	.....	.....
Do	Center of sec. 8, T. 19 S., R. 47 E., W. M. (Snake River water).	Wilson ditch	....do.....	102	50	.....	0	700	443	371	.....	.....	1,900	.....	.....
Texas	Near Quanah (in flood)	North Groesbeck Creek	May, 1905	525	79	206	0	183	1,630	273	.089	.....	3,000	.....	.....
Do	....do.....	....do.....	July, 1905	604	122	448	0	126	1,820	767	0	.....	4,080	.....	.....
Washington	Conconully	Salmon Creek [a]	Aug. 21, 1905	42	9	[b] 16	0	119	42	5	.044	.....	171	.....	.....
Do	....do.....	Scotch Creek [a]	....do.....	76	14	[c] 22	0	253	40	6	.089	.....	268	.....	.....
Wyoming	Domestic supply of Cody	Shoshone River	Mar. 7, 1906	.....	.....	.....	0	285	.....	21	.....	.....	496	.....	.....
Do	....do.....	....do.....	Mar. 13, 1906	.....	.....	.....	0	149	.....	18	.....	36	476	.....	.....
Do	....do.....	....do.....	Mar. 24, 1906	.....	.....	.....	0	305	.....	18	.....	28	416	.....	.....
Do	....do.....	....do.....	May 12, 1906	.....	.....	.....	0	178	.....	4	.....	174	368	.....	.....

[a] Iron, 0.2.

[b] Sodium, 8.9; potassium, 9.6.

[c] Sodium, 16; potassium, 8.5.

Miscellaneous analyses of springs and lakes.

[Milligrams per liter.]

State.	Location.	Source.	Date.	Calcium (Ca).	Magnesium (Mg).	Sodium and potassium ($Na+\frac{3}{4}K$).	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Sulphate radicle (SO_4).	Chlorine (Cl).	Nitrate radicle (NO_3).	Dissolved solids.
California	Near Springville, Cal	Mineral spring [a]	Nov. 1, 1905				0	1,260	21	618	0	2,140
Do	2,000 feet off east shore	Owens Lake [b]	Aug. 25, 1905	34	15	81,500	43,100	7,800	21,200	52,900	214	212,000
Colorado	8,500 feet above line of Gunnison Tunnel, near Montrose.	Neiswanger Spring	Oct. 20, 1904				0	185		6		230
Nebraska	Near Mitchell	Spotted Tail Springs	Sept. 29, 1905				0	252	Small.	14		316
Do	Sec. 28, T. 24 N., R. 57 W., 6th P. M.	Water hole	Oct. 4, 1905				0	63	33	16		228
Nevada	Outlet of Carson Lake, near Hill.	Stillwater Slough	Aug. 19, 1905				0	328	Heavy.	706		2,390
Do	Eastern edge, near Hill	Carson Lake	do				0	290	Heavy.	424		1,540
Do	Center, near Hill	do	Jan. 8, 1906	58	113	2,370	156	374	2,080	2,420		7,550
New Mexico	NW. ¼ sec. 17, T. 20 S., R. 26 E., N. Mex. M.	Johnson Springs	Dec., 1905	347	143	[c] 88	0	236	1,320	67		2,330
Do	Sec. 18, T. 20 S., R. 26 E., N. Mex. M.	Fannin Spring	do	233	79	[d] 18	0	265	726	18		1,360
Do	Johnson ranch, below Lake McMillan.	Spring in Pecos River	do	420	93	[e] 200	0	168	1,380	292		2,590
Do	Tonsill Dam	Spring	Feb., 1906	414			0	218	1,830	931		4,440
Oregon	Head of Ana River	Spring [f]	Dec., 1906	12	6	55	0	116	12	39	0	220
Do	C. W. Comeggs, Alkali Lake	do [f]	do	13	8	82	0	167	29	34	0	280
Do	½ mile east of Klamath Falls.	Klamath Hot Springs	June, 1905	38	4	208	0	50	446	58	.04	897
Do	do	do	June 2, 1906	32	3	223	5	33	425	58	0	862
Do	NE. ¼ sec. 27, T. 17 S., R. 44 E., W. M.	Harris Spring	Mar., 1905	39	11		0	196	42	14		346
Do	Vale	Hot Springs [g]	do	26	9		0	130	128	385		1,120
Do	Near Klamath Falls	Clear Lake [h]	Sept. 12, 1905									156
Do	do	Tule Lake [i]	July 22, 1905				12	254	Small.	22		268
Washington	Conconully	Lake 4,000 feet from Scotch Creek. [j]	Aug. 21, 1906		14	29	0	325	48	6	.04	351

[a] SiO_2, 76; $Fe_2O_3+Al_2O_3$, 19.

[b] SiO_2, 298; $Fe_2O_3+Al_2O_3$, 90; Na, 81,200; K, 345; Li, 57; As, 84; Cs, Rb, and Th, trace; PO_4, 238; B_4O_7, 298; specific gravity, 1.1954. The results have been corrected for specific gravity and are therefore in parts per million by weight and not milligrams per liter.

[c] Na, 77; K, 14.

[d] Na, 11; K, 9.6.

[e] Na, 196; K, 5.4.

[f] Published in Water-Supply Paper 220, p. 72.

[g] Boiling temperature.

[h] Suspended matter, 66.

[i] Composite of 6 samples.

[j] Na, 20; K, 11; Fe, 0.2.

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Miscellaneous analyses of water from wells and borings.

[Milligrams per liter.]

State.	Location.	Source.	Depth (feet).	Date.	Calcium radicle (Ca).	Magnesium radicle (Mg).	Sodium and potassium radicles ($Na+\frac{2}{3}K$).	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Sulphate radicle (SO_4).	Chlorine radicle (Cl).	Nitrate radicle (NO_3).	Dissolved solids (Ds).
Arizona	Yuma	Well [a]		Jan. 22, 1906				0	481		128	0	914
California	Stockton asylum	do	1,990	Mar., 1907	600	171	1,370	0	84	8	3,620		6,940
Do	SE. ¼ sec. 17, T. 11 S., R. 18 E., M. D. M.	do		July, 1905				0	174		85		380
Do	NE. ¼ sec. 11, T. 7 S., R. 12 E., M. D. M.	do		do				0	123		14		328
Do	SW. ¼ sec. 23, T. 7 S., R. 13 E., M. D. M.	do		do				7	336		70		584
Do	Tulare	Artesian well		Dec., 1905				0	1,630		436		2,110
Do	Porterville	Well		do				0	205		2		250
Do	Goshen	do		do				3	82		7		156
Do	Firebaugh	do		do				0	195		225		1,420
Do	Buttonwillow	do		do				0	455		35		816
Do	Bakersfield	do		do				0	254		21		358
Do	Dudley	do		do				0	241		183		2,090
Colorado	G. T. Woodruff, new well, SW. ¼ sec. 13, near Montrose.	do	42	Oct.. 1904				0	315		20		2,730
Idaho	Sec. 13, T. 9 S., R. 23 E., B. M.	Government well		May 11, 1905				0	220	Small.	30		380
Do	Sec. 23, T. 10 S., R. 23 E., B. M.	Well		Apr. 23, 1905				12	185	56	36	0	367
Montana	Headquarters camp, U. S. R. S., near Glendive.	do		June 9, 1905			132	0	543	164	20		638
Do	do	do		Dec. 12, 1905	99	42	182	0	647	250	6		854
Nebraska	U. S. R. S. headquarters, Mitchell [a]	do		Sept. 22, 1906	87	30	62	0	350	89	20	1.8	556
Do	Field's house, Mitchell [b]	do		do	78	29	56	0	327	82	15	.89	497
Do	Raymond ranch, near Mitchell	do		Sept. 29, 1905	44	12	50	0	201	32	4		309
Nevada	Gates, sec. 1, T. 18 N., R. 28 E., M. D. M.	Bored well	20	Apr. 24, 1906	67	20	[c] 94	0	239	168	39		586
Do	H. A. Stevens, sec. 2, T. 19 N., R. 27 E., M. D. M.	Well	73	June, 1906	27	8	62	0		36	15		280
Do	M. G. Mason, sec. 10, T. 19 N., R. 27 E., M. D. M.	do	50	do	46	10	56	0		56	15		280
New Mexico	Lake Avalon	do		do	125	63	106	12	319	234	99		884
Do	do [d]	do		do	488	126		0	537	1,320	30		2,630
Do	Fitzgerald, near Roswell	do	[e] 190	Mar., 1905	183	59	[f] 298	0	240	398	560	.18	1,760
Do	do	do	[e] 380	do	182	58	[g] 380	0	243	421	666	.18	2,000
North Dakota	Sec. 32, T. 152 N., R. 104 W., 6th P. M.	do		June 23, 1905				6	908		45		2,940

Do	U. S. R. S. camp 1, near Belle Fourche.	Artesian well		Aug., 1905	10	2	154	16	222	141	16	.04	482
Oklahoma	Hilton Hotel, Snyder	Well	25	Dec. 22, 1905	97			0	394	103	548		1,340
Do	E. L. B., Snyder	do	20	do	93			0	418	193	704		1,720
Do	Snyder	Boring 1	20	Spring, 1907				28	253	120	192		892
Do	do	Well 2	24	do				33	276	144	196		960
Do	do	Well 3	15	do				28	162	48	32		532
Do	do	Well 4	23	do				19	229	97	132		780
Do	do	Well 5	20	do				47	339	243	402		1,440
Do	do	Well 6	18	do				75	465	568	964		2,910
Do	do	Well 7	8	do				38	305	78	59		560
Do	do	Well 18	13	do				14	200	1,210	1,970		5,600
Do	do	Well 19	10	do				14	214	1,120	1,410		4,540
Do	do	Boring 20	12	do				33	300	465	650		2,280
Do	do	Well 21	12	do				19	205	37	23		400
Do	do	Well 22	12	do				28	744	48	37		488
Do	do	Boring 23	15	do				0	236	41	29		416
Do	do	Well 24	10	do				0	253	35	46		536
Do	do	Boring 25	10	do				0	254	40	41		388
Do	do	Well 26	6	do				0	233	344	402		1,430
Do	do	Boring 27	12	do				0	119	686	1,050		3,300
Do	do	Well 29	12	do				0	156	894	1,210		3,560
Do	do	Boring 30	8	do				0	172	574	366		1,780
Do	do	Well 31	6	do				0	152	970	1,460		4,220
Do	do	Boring 32	15	do				56	310	101	137		880
Do	do	Well 33	20	do				47	248	194	320		1,140
Do	do	Boring 34	9	do				0	219	400	804		2,200
Do	do	do	24	do				9	383	91	155		832
Do	do	Boring 35	7	do				9	305	68	82		584
Do	do	do	3–9	do				84	124	178	338		1,030
Do	do	Boring 36	22	do				9	374	84	64		664
Do	do	Well 36	12	do				0	105	520	1,020		2,800
Do	do	Well 37	30	do				28	324	68	59		600
Do	do	Boring 37	6	do				19	277	123	219		840
Do	do	Well 38	10	do				9	152	37	18		220
Do	do	Boring 39	6	do				0	76	45	18		148
Do	do	do	40	do				94	296	78	110		680
Do	do	Well 40	10	do				19	100	52	59		328
Do	do	Well 42	15	do				9	277	39	18		400
Do	do	Boring 43	26	do				0	343	124	119		744
Do	do	Well 44	24	do				28	372	96	124		740
Do	do	do	15	do				28	324	84	124		776
Do	do	Well 45	24	do				23	415	88	137		840

[a] Nitrogen: As free ammonia, .000; as albuminoid ammonia, .180; as nitrites, .140; as nitrates, .0001. Oxygen consumed, 6.8.
[b] Nitrates, heavy.
[c] Na, 88; K, 8.3.
[d] H_2S, 200.
[e] Depth from which sample was taken.
[f] Na, 291; K, 9.5.
[g] Na, 371; K, 12.

Miscellaneous analyses of water from wells and borings—Continued.

State.	Location.	Source.	Depth (feet).	Date.	Calcium radicle (Ca).	Magnesium radicle (Mg).	Sodium and potassium radicles ($Na+\frac{3}{4}K$).	Carbonate radicle (CO_3).	Bicarbonate radicle (HCO_3).	Sulphate radicle (SO_4)	Chlorine radicle (Cl).	Nitrate radicle (NO_3).	Dissolved solids (Ds).
Oklahoma	Snyder	Boring 46	35	Spring, 1907				19	296	88	119		728
Do	do	Boring 50	19	do				19	391	217	549		1,650
Do	do	Well 51	10	do				28	434	128	256		1,120
Do	do	Boring 52	11	do				0	357	153	247		948
Do	do	Boring 53	16	do				0	315	241	356		1,260
Do	do	Well 54	11	do				0	315	47	64		560
Do	do	Boring 55	11	do				28	238	35	41		372
Do	do	Boring 56	15	do				9	276	63	82		520
Do	do	Boring 57	6	do				0	305	31	18		420
Do	do	Boring 58	5	do				0	410	38	27		496
Do	do	Boring 59	6	do				9	220	119	100		720
Oregon	J. Wilson, near Fossil Lake [a]	Well		Dec., 1906	22	17	84	0	253	25	20	0	368
Do	J. C. Green, near Fossil Lake [a]	do		do	56	48	700	0	788	880	152	Trace.	2,350
Do	John Ross, Christmas Lake Valley [a]	do		do	82	82	1,280	0	440	2,040	574	.01	4,330
Do	McDade, Umatilla project	do		Nov. 19, 1905	91	48	[b] 353	31	780	266	210	4.5	1,590
Do	NE. ¼ sec. 10, T. 19 S., R. 43 E., W. M.	do	40	do	100	43		0	248	324	103		980
Do	NW. ¼ sec. 4, T. 19 S., R. 44 E., W. M.	do	12	do				0	493	357	256		1,420
Do	SE. ¼ sec. 15, T. 19 S., R. 44 E., W. M.	do	15	do	99	23		0	602	209	13		1,080
Do	NE. ¼ sec. 5, T. 19 S., R. 47 E., W. M., Ralph Mulder.	do	25	do	250	66		0	491	418	268		1,510
Do	SE. ¼ sec. 6, T. 19 S., R. 47 E., W. M., Morris Townsen.	do	50	do	36	17		0	356	94	50		584
Do	SW. ¼, sec. 29, T. 19 S., R. 47 E., W. M.	do	15	do	93	69		0	456	226	202		1,120
Do	SE. ¼ sec. 20, T. 18 S., R. 44 E., W. M., Tom Johnson.	do	16	do	59	39		0	542	114	84		808
Do	SW. ¼ sec. 12, T. 18 S., R. 46 E., W. M., G. W. Blanton.	do	15	do	222	80		0	791	994	328		2,760
Do	SW. ¼ sec. 18, T. 18 S., R. 46 E., W. M., T. W. Halliday.	do	18	do	170	62		0	521	392	152		1,360
Do	SE. ¼ sec. 19, T. 18 S., R. 46 E., W. M., A. A. Brown.	do	12	do	34	18		0	422	206	92		956
Do	E. ½ sec. 24, T. 18 S., R. 46 E., W. M.	do	40	do	130	44		0	375	342	100		1,100
Do	SW. ¼ sec. 17, T. 18 S., R. 47 E., W. M., J. M. Butler.	do	[c] 205	do	33	17		0	365	23	58		512
Do	NW. ¼ sec. 25, T. 17 S., R. 44 E., W. M.	do	15	do	122	74		0	420	128	81		860

Do	NE. ¼ sec. 2, T. 17 S., R. 47 E., W. M., Henshaw.	do	[d]15	do	74	20		0	339	59	30		572
Do	Sec. 33, T. 17 S., R. 47 E., W. M., Tom Brosnan.	do	260	do	31	20		0	736	26	42		814
Do	SW. ¼ sec. 26, T. 16 S., R. 47 E., W. M., J. B. Gorton.	do	[d]65	do	51	18		0	328	18	16		430
Washington	Conconully, 800 feet from Scotch Creek.	do		Aug. 21, 1905	75	13	[e]33	0	106	143	5		304

[a] Published, in Water-Supply Paper 220, p. 72.
[b] Na, 344; K, 12.
[c] Twelve feet to water.
[d] To water.
[e] Na, 24; K, 11. Fe, 0.2.

ANALYSES OF SUSPENDED MATTER.

Colorado River and the Rio Grande carry more matter in suspension than do most other streams in the United States. The nature of this suspended matter and its fertilizing value are of special interest. Analyses of the mineral matter carried by these two streams were made at various times in 1905. The results of plant food analyses, by the method of the Association of Official Agricultural Chemists, and the ultimate composition of the suspended matter obtained by the fusion method are presented in the following tables:

Analyses of suspended matter in water from Colorado River and the Rio Grande in 1905.

Constituent.	Colorado River at Yuma.								Rio Grande at El Paso.		Rio Grande at San Marcial.	
	Jan. to Apr.	May.	June.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan. to Sept.	Oct. to Dec.	Jan. to Sept.	Oct. to Dec.
Insoluble residue	68.65	75.80	78.97	75.20	61.80	62.83	66.40	68.80	65.50	65.00	63.74	67.00
Soluble silica (SiO_2)	.10	.09	.09	.03	.05	.03	.04	.03	.12	.13	.13	.13
Potassium oxide (K_2O)	.71	.61	.39	.82	1.31	1.25	.91	.98	.77	.95	.96	.77
Sodium oxide (Na_2O)	.33	.30	.17	.21	.23	.29	.17	.20	.36	.40	.23	.18
Calcium oxide (CaO)	5.32	4.95	5.15	4.69	6.28	7.68	6.52	4.73	4.28	4.17	4.17	4.08
Magnesium oxide (MgO)	2.40	1.97	1.17	1.59	1.93	2.68	2.54	2.28	2.12	2.30	1.98	1.97
Iron and aluminum oxides ($Fe_2O_3+Al_2O_3$)	13.45	9.37	7.19	10.62	17.45	16.04	14.76	14.25	17.78	17.69	18.81	16.64
Phosphoric acid (P_2O_5)	.37	.24	.29	.24	.18	.24	.29	.31	.35	.56	.40	.49
Sulphuric acid (SO_3)	.24	.20	.13	.09	.19	.11	.11	.07	.32	.24	.26	.17
Water and organic matter	8.00	6.34	4.59	5.62	10.20	10.19	8.97	8.02	9.30	8.98	9.25	8.32
Total nitrogen (N)	.07	.08	.07	.02	.09	.08	.09	.08	.09	.08	.09	.07

Ultimate composition of suspended matter in water from Colorado River at Yuma, Ariz., May, 1905, and from Rio Grande at San Marcial, N. Mex., October to December, 1905.

Constituent.	Colorado River.	Rio Grande.
Silica (SiO_2)	65.09	56.77
Iron oxide (Fe_2O_3)	3.79	3.49
Aluminum oxide (Al_2O_3)	11.50	19.62
Manganese oxide (MnO)	.31	.30
Calcium oxide (CaO)	6.34	4.74
Magnesium oxide (MgO)	1.97	1.97
Sodium oxide (Na_2O)	1.66	1.53
Potassium oxide (K_2O)	2.62	2.87
Phosphoric acid (P_2O_5)	.33	.51
Sulphuric acid (SO_3)	.47	.48
Organic and volatile matter	6.34	8.32

SEDIMENT CARRIED BY THE RIO GRANDE.

By HERMAN STABLER.

BASIC DATA.

The following study of the sediment carried by the Rio Grande is based on (1) measurements made at San Marcial, N. Mex., by the International Boundary Commission and published by the United States Geological Survey; and (2) determinations of silt, by weight, made for the Reclamation Service in the laboratory at Berkeley, Cal., under the direction of T. H. Means and W. H. Heileman.

The stream measurements and computations of flow were made in accordance with the usual methods for shifting channels, and reliable results are available for the 12 years beginning with 1897. The analytical results were developed from determinations, by the indirect method, of the weight of suspended matter in samples collected for the most part twice a week from the Rio Grande at San Marcial, N. Mex., from May 28, 1905, to April 27, 1906.

TABULATED ESTIMATES.

In Table 1 are presented the daily discharge of water, in acre-feet (obtained by multiplying the published discharge in second-feet by 2); the actual individual determinations of per cent, by weight, of suspended matter; estimates of the per cent, by volume, of sediment for each day (made from the basic data on the assumption that 85 pounds of suspended matter will make a cubic foot of sediment); and estimates of the daily discharge, in acre-feet, of sediment.

TABLE 1.—*Water and sediment in the Rio Grande at San Marcial, N. Mex., May, 1905, to April, 1907.*

Day.	May, 1905.				June, 1905.				July, 1905.			
	Discharge in acre-feet.	Per cent, by weight, of sediment.	Per cent, by volume, of sediment.	Sediment in acre-feet.	Discharge in acre-feet.	Per cent, by weight, of sediment.	Per cent, by volume, of sediment.	Sediment in acre-feet.	Discharge in acre-feet.	Per cent, by weight, of sediment.	Per cent, by volume, of sediment.	Sediment in acre-feet.
1	15,000				38,700				5,540			
2	15,300				39,300				3,980			
3	15,500				39,900	0.454	[a]0.333		3,200	0.139	[a]0.102	
4	21,700				34,200				2,750			
5	24,400				32,700				2,520			
6	24,200				33,000	.454	*a*.333		2,290	.139	*a*.102	
7	21,900				31,600				2,090			30.9
8	20,000				30,900				1,930			
9	21,100				30,100			1,740	1,570	.139	*a*.102	
10	19,300				31,900				1,330			
11	17,400				34,800				1,090			
12	21,200				36,900	.454	*a*.333		930	.139	*a*.102	
13	20,100				32,700				930			
14	21,400				27,100				740			
15	20,300				24,300	.454	*a*.333		550	2.035	[a]1.49	
16	23,500				23,800				550			
17	25,100				25,600				460			
18	27,400				27,500	.429	*a*.315		380	2.035	[a]1.49	
19	30,800				21,900				370			
20	33,100				20,300				360			
21	34,700				17,600	.429	*a*.315	518	350	2.035	[a]1.49	82.6
22	46,800				15,000				340			
23	57,200				13,400				330			
24	58,100				12,700	.429	*a*.315		320	2.035	[a]1.49	
25	47,100				10,600				240			
26	56,000				8,160	.139	*a*.102		240			
27	54,200				7,000				160	2.035	[a]1.49	
28	51,200	[a]0.454			7,000	.139	*a*.102	34	140			
29	47,200				6,140				140			
30	40,900	*a*.454			5,280	.139	*a*.102		130			6.8
31	38,100								130	2.315	[a]1.70	
Total [b] and mean	962,221	.454	.333	3,200	714,268	.437	.321	2,292	35,782	.457	.336	120.3

a Composite of samples taken on days indicated by like numbers.

b The daily discharge in acre-feet was obtained by taking twice the recorded discharge in second-feet, and the values are therefore a little over 1 per cent too large. The monthly totals are the values reported by the Geological Survey.

TABLE 1.—*Water and sediment in the Rio Grande at San Marcial, N. Mex., May, 1905, to April, 1907*—Continued.

Day.	August, 1905.				September, 1905.				October, 1805.			
	Discharge in acre-feet.	Per cent, by weight, of sediment.	Per cent, by volume, of sediment.	Sediment in acre-feet.	Discharge in acre-feet.	Per cent, by weight, of sediment.	Per cent, by volume, of sediment.	Sediment in acre-feet.	Discharge in acre-feet.	Per cent, by weight, of sediment.	Per cent, by volume, of sediment.	Sediment in acre-feet.
1	810	.....	.....		0	.....	.....		360	.....	2.4	8.6
2	990	.....	.....		0	.....	.....		340	3.19	2.34	8.0
3	1,290	2.315	a1.700		0	.....	.....		330	.....	2.3	7.6
4	1,290	.....	.....		0	.....	.....		320	.....	2.2	7.0
5	1,140	.....	.....		0	.....	.....		320	2.92	2.14	6.9
6	1,290	2.315	a1.700		360	.....	.....		310	.....	2.0	6.2
7	1,140	.....	.....		640	.....	.....		300	.....	1.7	5.1
8	1,160	.....	.....		300	.....	.....	173.0	250	.....	1.4	3.5
9	1,400	.....	.....		300	10.20	7.49		210	.....	1.1	2.3
10	1,340	.....	.....		390	.....	.....		170	1.29	.951	1.6
11	1,290	.....	.....	344	190	.....	.....		170	.887	.651	1.1
12	1,420	.....	.....		100	.....	.....		190	.....	.65	1.2
13	1,240	.....	.....		20	.....	.....		190	.....	.60	1.1
14	1,180	.....	.....		10	.....	.....		190	.747	.548	1.0
15	940	2.315	a1.700		0	.....	.....		190	.....	.54	1.0
16	700	.....	.....		0	.....	.....		170	.....	.53	.9
17	510	.....	.....		0	.....	.....		160	.720	.529	.8
18	290	2.315	a1.700		0	.....	.....		160	.....	.50	.8
19	250	.....	.....		0	.....	.....		170	.....	.46	.8
20	220	.....	.....		0	.....	.....	.4	170	.606	.445	.8
21	190	2.315	a1.700		0	.....	.....		170	.....	.44	.7
22	120	.....	.....		0	.....	.....		190	.....	.45	.9
23	50	.....	.....	0.0	0	.....	.....		190	.597	.438	.8
24	10	.078	.057		0	.....	.....		180	.....	.43	.8
25	0	.....	.....	.....	100	.440	.323		210	.....	.50	1.0
26	0	.....	.....	.....	940	.....	7.5	70.5	250	.741	.544	1.4
27	0	.....	.....	.....	800	9.92	7.29	58.3	270	.....	.52	1.4
28	0	.....	.....	.....	290	.....	3.	8.7	300	.685	.503	1.5
29	0	.....	.....	.....	460	5.09	3.74	17.2	360	.....	.60	2.2
30	0	.....	.....	.....	420	.....	3.5	14.7	360	.....	.60	2.2
31	0	.....	.....	.....	.....	.....	.....	.....	340	.795	.584	2.0
Total[b] and mean	20,093	2.33	1.71	344.0	5,276	8.80	6.46	342.8	7,349	1.46	1.07	79.2

[a] Composite of samples taken on days indicated by like numbers.

[b] The daily discharge in acre-feet was obtained by taking twice the recorded discharge in second-feet, and the values are therefore a little over 1 per cent too large. The monthly totals are the values reported by the Geological Survey.

TABLE 1.—*Water and sediment in the Rio Grande at San Marcial, N. Mex., May, 1905, to April, 1907*—Continued.

Date.	November, 1905.				December, 1905.				January, 1906.			
	Discharge in acre-feet.	Per cent, by weight, of sediment.	Per cent, by volume, of sediment.	Sediment in acre-feet.	Discharge in acre-feet.	Per cent, by weight, of sediment.	Per cent, by volume, of sediment.	Sediment in acre-feet.	Discharge in acre-feet.	Per cent, by weight, of sediment.	Per cent, by volume, of sediment.	Sediment in acre-feet.
1	320	.....	0.50	1.6	3,060	.....	1.8	55.1	310	.....	0.050	0.2
2	320	.....	.50	1.6	1,980	.....	1.4	27.7	250	0.035	.026	.1
3	350	0.718	.527	1.8	1,630	1.34	.984	16.0	310	.....	.040	.1
4	440	.....	.60	2.6	1,360	.....	.80	10.9	370	.....	.050	.2
5	520	.....	.80	4.2	1,220	.....	.60	7.3	560	.091	.067	.4
6	570	.....	.85	4:8	1,010	.651	.478	4.8	560	.....	.060	.3
7	750	.....	.90	6.8	1,170	.....	.45	5.3	520	.....	.055	.3
8	1,100	.....	1.10	12.1	1,210	.....	.45	5.4	480	.068	.050	.2
9	1,380	1.54	1.13	15.6	1,130	.570	.418	4.7	480	.....	.050	.2
10	900	.....	.50	4.5	1,310	.....	.40	5.2	520	.....	.050	.3
11	1,330	.064	.0470	0.6	1,310	.....	.36	4.7	570	.062	.046	.3
12	1,160	.....	.50	5.8	1,210	.455	.334	4.4	600	.....	.050	.3
13	1,020	.....	.50	5.1	1,320	.....	.33	4.5	810	.....	.10	.8
14	1,100	.859	.630	6.9	1,320	.....	.33	4.5	1,030	.217	.159	1.6
15	1,060	.....	.58	6.1	1,480	.483	.352	5.2	1,440	.....	.20	2.9
16	960	.....	.53	5.1	1,540	.....	.35	5.4	1,960	.....	.30	5.9
17	960	.660	.485	4.7	1,390	.....	.32	4.5	2,500	.583	.428	10.7
18	960	.....	.45	4.3	1,240	.392	.288	3.6	2,640	.....	.45	11.9
19	960	.....	.42	4.0	1,290	.....	.29	3.7	2,780	.....	.50	13.9
20	960	.554	.407	3.9	1,290	.....	.29	3.7	2,620	.774	.568	14.9
21	960	.....	.40	3.8	1,290	.389	.286	3.7	2,260	.....	.50	11.3
22	1,080	.....	.50	5.4	1,030	.....	.25	2.6	1,900	.....	.45	8.5
23	1,210	.743	.546	6.5	890	.....	.20	1.8	1,400	.582	.427	6.0
24	7,440	.....	3.	223.2	460	.209	.154	.7	1,120	.....	.30	3.4
25	3,840	3.19	2.34	90.0	350	.....	.10	.4	1,080	.....	.20	2.2
26	3,240	.....	2.0	64.8	320	.....	.05	.2	970	.195	.143	1.4
27	2,320	.....	1.5	34.8	350	.071	.052	.2	1,050	.....	.20	2.1
28	1,240	1.36	1.00	12.4	360	.....	.06	.2	1,290	.....	.25	3.2
29	1,240	.....	1.0	12.4	370	.....	.09	.4	1,610	.359	.264	4.3
30	3,060	2.45	1.80	55.1	370	.119	.087	.3	1,510	.....	.25	3.8
31	.....	.....	.....	.....	370	.....	.85	.3	1,300	.322	.236	3.1
Total[a] and mean	42,397	1.97	1.44	610.6	34,344	.783	.575	197.4	36,496	.428	.315	114.8

[a] The daily discharge in acre-feet was obtained by taking twice the recorded discharge in second-feet, and the values are therefore a little over 1 per cent too large. The monthly totals are the values reported by the Geological Survey.

TABLE 1.—*Water and sediment in the Rio Grande at San Marcial, N. Mex., May, 1905, to April, 1907*—Continued.

Day.	February, 1906.				March, 1906.				April, 1906.			
	Discharge in acre-feet.	Per cent, by weight, of sediment.	Per cent, by volume, of sediment.	Sediment in acre-feet.	Discharge in acre-feet.	Per cent, by weight, of sediment.	Per cent, by volume, of sediment.	Sediment in acre-feet.	Discharge in acre-feet.	Per cent, by weight, of sediment.	Per cent, by volume, of sediment.	Sediment in acre-feet.
1	1,430	.....	0.30	4.3	1,580	.....	0.25	4.0	2,520	.....	1.00	25.2
2	1,440	.....	.40	5.8	1,520	.....	.24	3.6	2,220	.....	1.00	22.2
3	1,250	0.638	.468	5.8	1,460	0.320	.235	3.4	2,420	1.390	1.02	24.7
4	1,250	.....	.50	6.2	1,240	.....	.24	3.0	2,660	.....	.90	23.9
5	1,250	.....	.50	6.2	1,220	.....	.24	2.9	2,900	.....	.80	23.2
6	1,410	1.035	.760	10.7	1,380	.335	.246	3.4	2,900	.900	.729	21.2
7	1,230	.....	.50	6.2	1,500	.....	.25	3.8	2,760	.....	.73	20.2
8	1,250	.....	.50	6.2	1,260	.....	.22	2.8	2,780	.....	.73	20.3
9	1,270	.609	.446	5.7	1,160	.268	.197	2.3	2,860	.998	.733	21.0
10	1,370	.....	.40	5.5	1,160	.....	.20	2.3	2,760	.....	.73	20.2
11	1,420	.....	.38	5.4	1,500	.....	.18	2.7	3,060	.....	.80	24.5
12	1,590	.499	.359	5.7	1,500	.241	.177	2.7	3,460	1.285	.943	32.6
13	1,590	.....	.35	5.6	1,160	.....	.20	2.3	3,380	.....	.90	30.4
14	1,750	.....	.34	6.0	1,400	.....	.30	4.2	3,540	.....	.95	33.6
15	1,750	.456	.335	5.9	1,840	.645	.473	8.7	4,040	.....	1.00	40.4
16	1,700	.....	.34	5.8	1,960	.....	.50	9.8	4,500	.....	1.10	49.5
17	1,650	.....	.34	5.6	1,840	.....	.50	9.2	4,800	.....	1.15	55.1
18	1,560	.475	.349	5.4	2,060	1.141	.839	17.3	5,320	1.626	1.20	63.8
19	1,420	.....	.30	4.3	2,220	.....	.85	18.9	5,600	.....	1.10	61.6
20	1,400	.....	.25	3.5	1,900	.....	.75	14.3	5,880	.....	1.00	58.8
21	1,440	.329	.241	3.5	1,580	.944	.694	11.0	6,640	1.136	.835	55.4
22	1,260	.....	.23	2.9	1,360	.....	.60	8.2	7,820	.....	.84	65.7
23	1,320	.....	.22	2.9	1,380	.....	.55	7.6	8,200	.....	.85	69.7
24	1,320	.298	.219	2.9	1,040	.664	.487	5.1	8,760	1.162	.854	74.8
25	1,340	.....	.22	2.9	1,260	.....	.60	7.6	9,340	.....	.80	74.7
26	1,360	.....	.22	3.0	1,480	.....	.75	11.1	12,000	.....	.70	84.0
27	1,560	.372	.273	4.3	1,480	1.073	.788	11.7	11,680	.905	.665	77.6
28	1,440	.....	.25	3.6	4,660	.....	.50	23.3	10,380	.....	.60	62.3
29	.....	.....	.....	.....	4,900	.....	.30	14.7	9,380	.....	.55	51.6
30	.....	.....	.....	.....	4,400	.284	.208	9.2	9,940	.703	.515	51.2
31	.....	.....	.....	.....	2,940	.....	.50	14.7	.....	.....	.....	.....
Total [a] and mean	39,689	.486	.357	141.8	56,866	.588	.432	245.8	163,140	1.119	.821	1,139.4

[a] The daily discharge in acre-feet was obtained by taking twice the recorded discharge in second-feet, and the values are therefore a little over 1 per cent too large. The monthly totals are the values reported by the Geological Survey.

TABLE 1.—*Water and sediment in the Rio Grande at San Marcial, N. Mex., May, 1905, to April, 1907*—Continued.

Day.	May, 1906.				June, 1906.				July, 1906.			
	Discharge in acre-feet.	Per cent, by weight, of sediment.	Per cent, by volume, of sediment.	Sediment in acre-feet.	Discharge in acre-feet.	Per cent, by weight, of sediment.	Per cent, by volume, of sediment.	Sediment in acre-feet.	Discharge in acre-feet.	Per cent, by weight, of sediment.	Per cent, by volume, of sediment.	Sediment in acre-feet.
1	9,940	.....	0.50	49.7	11,960	.....	0.28	33.5	3,900	.....	0.60	23.4
2	10,760	.....	.45	48.3	11,180	.....	.27	31.8	3,420	0.817	.600	20.5
3	9,120	0.588	.433	39.5	10,640	0.364	.267	28.4	3,620	.....	.55	19.9
4	8,860	.....	.42	37.2	11,120	.....	.28	31.1	4,220	.....	.50	21.1
5	8,420	.....	.40	33.7	10,120	.....	.30	30.4	4,620	.668	.490	22.6
6	8,780	.538	.395	34.7	10,100	.....	.31	31.3	4,220	.....	.47	19.8
7	11,780	.....	.45	53.0	10,600	.438	.322	34.1	4,620	.....	.46	21.3
8	14,160	.....	.50	70.8	10,600	.....	.30	31.8	5,160	.903	.663	34.2
9	14,160	.658	.483	68.4	10,600	.....	.25	26.5	4,900	.....	.70	34.3
10	15,600	.....	.60	93.6	10,860	.332	.244	26.5	4,780	.....	.75	35.8
11	16,460	.....	.65	107.0	11,140	.....	.25	27.8	4,380	1.060	.778	34.1
12	18,740	.990	.727	136.2	11,720	.....	.25	29.3	4,060	.....	.60	24.4
13	20,160	.....	.70	141.1	12,480	.349	.256	31.9	4,020	.....	.50	20.1
14	20,680	.....	.60	124.1	13,540	.....	.27	36.8	3,860	.624	.458	17.7
15	20,900	.578	.424	38.9	16,040	.....	.29	46.5	3,980	.....	.40	15.9
16	19,560	.....	.40	78.2	17,000	.425	.312	53.1	4,420	.....	.40	17.7
17	19,420	.....	.38	73.8	16,880	.....	.31	52.3	4,220	.554	.407	17.2
18	19,300	.492	.361	69.7	17,060	.....	.32	54.6	4,360	.....	.45	19.6
19	17,700	.....	.35	62.0	16,660	.443	.325	54.2	4,540	.....	.50	22.7
20	17,900	.....	.40	71.6	15,680	.....	.30	47.0	5,280	.790	.580	30.6
21	20,120	.....	.45	90.5	14,400	.....	.27	38.9	4,680	.....	.45	21.1
22	21,600	.654	.480	103.7	13,760	.....	.24	33.0	4,100	.....	.40	16.4
23	21,400	.....	.46	98.5	12,400	.....	.20	24.8	3,520	.430	.316	11.1
24	20,500	.....	.44	90.3	10,300	.....	.18	18.5	3,230	.....	.28	9.0
25	20,320	.574	.421	85.5	9,180	.....	.15	13.8	2,780	.....	.24	6.7
26	19,780	.....	.40	79.1	8,660	.117	.086	7.5	2,340	.249	.183	4.3
27	18,660	.....	.38	71.0	7,360	.....	.10	7.4	2,340	.....	.22	5.2
28	17,820	.499	.366	65.2	5,860	.....	.15	8.8	2,140	.....	.26	5.6
29	15,260	.....	.32	48.8	5,420	.234	.172	9.3	2,140	.403	.296	6.3
30	14,260	.....	.30	42.8	4,620	.....	.40	18.5	2,560	.....	.50	12.8
31	12,760	.393	.288	36.7	.....	.....	.....	.....	2,900	.854	.627	18.2
Total[a] and mean	500,707	.624	.458	2,293.6	345,064	.364	.267	919.4	118,314	.678	.498	589.6

[a] The daily discharge in acre-feet was obtained by taking twice the recorded discharge in second-feet, and the values are therefore a little over 1 per cent too large. The monthly totals are the values reported by the Geological Survey.

TABLE 1.—*Water and sediment in the Rio Grande at San Marcial, N. Mex., May, 1905, to April, 1907*—Continued.

Day.	August, 1906.				September, 1906.				October, 1906.			
	Discharge in acre-feet.	Per cent, by weight, of sediment.	Per cent, by volume, of sediment.	Sediment in acre-feet.	Discharge in acre-feet.	Per cent, by weight, of sediment.	Per cent, by volume, of sediment.	Sediment in acre-feet.	Discharge in acre-feet.	Per cent, by weight, of sediment.	Per cent, by volume, of sediment.	Sediment in acre-feet.
1	3,880	.....	0.90	34.9	340	.....	2	6.8	2,220	.....	1.2	26.6
2	3,350	.....	1.0	33.5	350	4.436	3.255	11.4	2,140	.....	1.15	24.6
3	2,940	1.720	1.26	37.1	250	.....	2.5	6.2	2,540	1.532	1.125	28.6
4	2,960	.....	1.0	29.6	160	.....	1.5	2.4	2,760	.....	1.0	27.6
5	2,980	.....	.90	26.8	140	1.492	1.095	1.5	2,760	.....	.85	23.5
6	2,720	1.084	.795	21.6	100	.....	1.3	1.3	2,760	.999	.733	20.2
7	2,190	.....	.75	16.4	80	.....	1.5	1.2	2,820	.....	.65	18.3
8	2,190	.....	.73	16.0	80	2.162	1.588	1.3	2,620	.....	.60	15.7
9	2,190	.976	.717	15.7	60	.....	1.6	1.0	2,360	.730	.537	12.7
10	1,950	.....	.75	14.6	40	.....	1.6	.6	2,220	.....	.45	10.0
11	1,950	.....	.75	14.6	20	.....	1.6	.3	2,020	.....	.40	8.1
12	1,250	1.039	.763	9.5	10	.....	1.6	.2	1,820	.495	.364	6.6
13	1,200	.....	.60	7.2	0	.....	.....	.0	1,880	.....	.35	6.6
14	1,150	.....	.50	5.8	0	.....	.....	.0	1,940	.....	.33	6.4
15	1,050	.684	.502	5.3	0	.....	.....	.0	2,000	.427	.314	6.3
16	1,320	.....	.80	10.6	0	.....	.....	.0	1,940	.....	.30	5.8
17	1,230	.....	.80	9.8	0	.....	.....	.0	2,040	.....	.30	6.1
18	840	1.216	.892	7.5	0	.....	.....	.0	1,760	.403	.296	5.2
19	810	.....	.50	4.0	0	.....	.....	.0	1,820	.....	.30	5.5
20	580	.....	.25	1.4	0	.....	.....	.0	1,880	.....	.30	5.6
21	440	.165	.121	.5	0	.....	.....	.0	2,020	.423	.311	6.3
22	440	.....	.20	.9	0	.....	.....	.0	2,160	.833	.611	13.2
23	400	.....	.30	1.2	0	.....	.....	.0	2,420	.....	.60	14.5
24	310	.613	.450	1.4	0	.....	.....	.0	2,500	.....	.60	15.0
25	210	.....	.50	1.0	30	.359	.290	.1	2,780	.820	.602	16.7
26	480	.....	.80	3.8	100	.....	1.00	1.0	2,500	.....	.60	15.0
27	640	1.332	.977	6.3	140	.....	1.00	1.4	2,420	.....	.60	14.5
28	590	.....	1.00	5.9	18,140	9.821	7.21	1,308	2,140	.813	.597	12.8
29	540	.....	1.00	5.4	3,580	.....	2.0	71.6	2,500	.....	.55	13.8
30	370	1.470	1.08	4.0	2,120	1.639	1.203	25.5	2,830	.....	.50	14.2
31	420	.....	1.00	4.2	.....	.....	.....	.....	2,620	.669	.491	13.8
Total[a] and mean	43,210	1.124	.825	356.5	25,527	7.68	5.64	1,441.8	70,830	.808	.593	419.8

[a] The daily discharge in acre-feet was obtained by taking twice the recorded discharge in second-feet, and the values are therefore a little over 1 per cent too large. The monthly totals are the values reported by the Geological Survey.

TABLE 1.—*Water and sediment in the Rio Grande at San Marcial, N. Mex., May, 1905, to April, 1907*—Continued.

Day.	November, 1906.				December, 1906.				January, 1907.			
	Discharge in acre-feet.	Per cent, by weight, of sediment.	Per cent, by volume, of sediment.	Sediment in acre-feet.	Discharge in acre-feet.	Per cent, by weight, of sediment.	Per cent, by volume, of sediment.	Sediment in acre-feet.	Discharge in acre-feet.	Per cent, by weight, of sediment.	Per cent, by volume, of sediment.	Sediment in acre-feet.
1	2,820	.....	0.47	13.2	2,960	.....	0.35	10.4	2,020	.....	0.12	2.4
2	2,960	.....	.45	13.3	2,780	0.492	.361	10.0	1,960	.....	.12	2.4
3	3,100	0.566	.416	12.9	2,840	.....	.40	11.4	2,070	0.169	.124	2.6
4	3,040	.....	.42	12.8	3,120	.....	.45	14.0	2,070	.....	.12	2.5
5	3,300	.....	.43	14.2	3,540	.746	.548	19.4	1,890	.....	.12	2.3
6	3,240	.590	.433	14.0	7,000	.....	.70	49.0	1,370	.152	.112	1.5
7	3,140	.....	.40	12.6	9,000	.....	.70	63.0	1,530	.....	.14	2.1
8	3,120	.....	.38	11.9	4,240	.892	.655	27.8	1,590	.....	.17	2.7
9	3,100	.511	.375	11.6	3,500	.....	.50	17.5	1,800	.268	.197	3.5
10	2,900	.....	.35	10.2	3,200	.....	.40	12.8	1,960	.....	.19	3.7
11	3,020	.....	.35	10.6	3,100	.376	.276	8.6	2,120	.....	.18	3.8
12	2,980	.442	.325	9.7	2,900	.....	.28	8.1	2,280	.239	.175	4.0
13	2,940	.....	.30	8.8	3,020	.....	.28	8.5	2,060	.....	.17	3.5
14	2,900	.....	.30	8.7	2,800	.388	.286	8.0	2,000	.....	.17	3.4
15	2,840	.400	.294	8.3	2,660	.....	.30	8.0	1,940	.232	.170	3.3
16	2,800	.....	.28	7.9	2,680	.....	.35	9.4	1,940	.....	.18	3.5
17	2,760	.....	.27	7.5	2,380	.573	.421	10.0	1,940	.....	.19	3.7
18	2,720	.....	.26	7.1	1,920	.....	.35	6.7	2,510	.271	.199	5.0
19	2,500	.....	.25	6.2	1,830	.....	.30	5.5	2,770	.....	.19	5.3
20	2,560	.335	.246	6.3	1,560	.330	.242	3.8	2,550	.....	.17	4.3
21	2,480	.....	.24	6.0	1,380	.....	.22	3.0	2,260	.209	.153	3.5
22	2,220	.....	.24	5.3	1,460	.....	.20	2.9	2,020	.....	.13	2.6
23	1,800	.317	.233	4.2	1,370	.264	.194	2.7	1,940	.....	.11	2.1
24	1,440	.....	.22	3.2	1,650	.....	.19	3.1	1,540	.134	.099	1.5
25	1,800	.....	.21	3.8	1,930	.....	.19	3.7	1,720	.....	.11	1.9
26	1,800	.282	.207	3.7	1,930	.255	.187	3.7	1,990	.....	.12	2.4
27	1,980	.....	.24	4.8	1,910	.....	.18	3.4	1,720	.....	.13	2.2
28	1,920	.....	.26	4.5	1,960	.....	.18	3.5	1,720	.188	.138	2.4
29	2,020	.368	.270	5.5	1,930	.248	.182	3.5	1,900	.....	.14	2.7
30	2,200	.....	.30	6.6	2,080	.....	.15	3.1	1,940	.178	.131	2.5
31	.....	.....	.....	.....	2,230	.170	.125	2.8	2,020	.....	.15	3.0
Total[a] and mean	77,752	.447	.328	255.4	86,142	.549	.403	347.3	60,635	.214	.152	92.3

[a] The daily discharge in acre-feet was obtained by taking twice the recorded discharge in second-feet, and the values are therefore a little over 1 per cent too large. The monthly totals are the values reported by the Geological Survey.

TABLE 1.—*Water and sediment in the Rio Grande at San Marcial, N. Mex., May, 1905, to April, 1907*—Continued.

Day.	February, 1907.				March, 1907.				April, 1907.			
	Discharge in acre-feet.	Per cent, by weight, of sediment.	Per cent, by volume, of sediment.	Sediment in acre-feet.	Discharge in acre-feet.	Per cent, by weight, of sediment.	Per cent, by volume, of sediment.	Sediment in acre-feet.	Discharge in acre-feet.	Per cent, by weight, of sediment.	Per cent, by volume, of sediment.	Sediment in acre-feet.
1	2,160	.....	0.15	3.2	2,780	.....	0.25	7.0	3,900	.....	0.25	9.8
2	2,120	0.227	.167	3.5	2,500	.....	.25	6.2	3,920	.....	.20	7.8
3	2,580	.....	.25	6.4	2,480	0.342	.251	6.2	3,480	0.254	.186	6.5
4	2,740	.....	.35	9.6	2,080	.....	.20	4.2	3,400	.....	.20	6.8
5	2,700	.573	.423	11.4	1,900	.....	.17	3.2	3,440	.....	.22	7.6
6	2.360	.....	.38	9.0	1,900	.234	.172	3.2	3,840	.320	.235	9.0
7	2,220	.....	.36	8.0	1,680	.....	.17	2.9	4,640	.....	.24	11.2
8	2,380	.466	.342	8.1	1,640	.....	.17	2.8	4,640	.....	.24	11.2
9	2,460	.....	.33	8.1	1,800	.231	.170	3.1	4,000	.325	.239	9.6
10	2,460	.....	.33	8.1	1,920	.....	.20	3.8	3,580	.....	.24	8.6
11	2,460	.444	.326	8.0	2,260	.....	.22	5.0	4,080	.....	.24	9.8
12	2,200	.....	.30	6.6	2,380	.304	.223	5.3	3,620	.325	.238	8.6
13	2,060	.....	.29	6.0	2,060	.....	.22	4.5	4,700	.....	.40	18.8
14	2,120	.383	.281	6.0	2,280	.....	.22	5.0	6.360	.580	.426	27.1
15	2,040	.....	.25	5.1	2,300	.303	.223	5.1	8,420	.....	.45	37.9
16	2,200	.....	.23	5.1	2,080	.....	.20	4.2	11,160	.778	.571	63.6
17	2,220	.292	.214	4.8	1,740	.....	.15	2.6	11,560	.....	.50	57.8
18	2,300	.....	.20	4.6	1,420	.179	.131	1.9	12,400	.....	.45	55.8
19	2,300	.....	.20	4.6	1,480	.....	.15	2.2	11,420	.575	.421	48.1
20	2,380	.258	.189	4.5	1,520	.....	.20	3.0	12,900	.....	.40	51.6
21	2,600	.....	.17	4.4	2,260	.303	.223	5.0	15,000	.....	.40	60.0
22	2,720	.....	.17	4.6	2,500	.....	.30	7.5	15,000	.527	.387	58.0
23	2,600	.218	.160	4.2	4,700	.624	.458	21.5	11,600	.....	.37	42.9
24	2,540	.....	.18	4.6	5,420	.....	.48	26.0	9,900	.481	.353	35.0
25	2,820	.....	.20	5.6	5,580	.....	.50	27.9	10,220	.....	.33	33.8
26	2,920	.322	.236	6.9	5,760	.691	.507	29.2	9,300	.....	.30	27.9
27	2,800	.....	.24	6.7	5,620	.....	.48	27.0	7,680	.368	.270	20.7
28	2,800	.335	.246	6.9	5,300	.....	.45	23.9	6,300	.....	.25	15.9
29	.....	.....	.....	.....	5,440	.....	.40	22.2	6,400	.....	.25	16.2
30	.....	.....	.....	.....	5,620	.....	.36	20.3	7,540	.....	.25	18.8
31	.....	.....	.....	.....	4,520	.442	.325	15.2	.....	.....	.....	.....
Total[a] and mean	67,696	.351	.258	174.6	92,549	.452	.332	307.1	222,863	.488	.358	796.4

[a] The daily discharge in acre-feet was obtained by taking twice the recorded discharge in second-feet, and the values are therefore a little over 1 per cent too large. The monthly totals are the values reported by the Geological Survey.

This table indicates that, though the usual rule of variation of per cent of sediment directly with discharge may hold for a few consecutive days, when the results for a long period are considered the stage of the river and the proportion of sediment exhibit no constant relation. This is readily accounted for by the influence of different tributaries, the abnormal effects of storms in the arid catchment area, and particularly by the influence of the Rio Puerco, which at times carries into the Rio Grande at low stage a flood of heavily silt-laden waters. Certain seasonal variations of the sediment-to-water ratio are noticeable, but they are not sufficiently well defined to be expressed in any simple mathematical law.

Monthly summaries of water and sediment discharged and of the sediment-water ratio are given in Table 2.

TABLE 2.—*Monthly discharge of water and sediment in acre-feet and sediment-water ratio in per cent for the Rio Grande at San Marcial, New Mexico.*

Month.	1905–6.			1906–7.		
	Water.	Sediment.	Ratio.	Water.	Sediment.	Ratio.
May	962,221	3,200	0.333	500,707	2,294	0.458
June	714,268	2,292	.321	345,064	919	.267
July	35,782	120	.336	118,314	590	.498
August	20,093	344	1.71	43,210	356	.825
September	5,276	343	6.46	25,527	1,442	.564
October	7,349	79	1.07	70,830	420	.593
November	42,397	610	1.44	77,752	255	.328
December	34,344	197	.575	86,142	347	.403
January	36,496	115	.315	60,635	92	.152
February	39,689	142	.357	67,696	175	.258
March	56,866	246	.432	92,549	307	.332
April	163,140	1,339	.821	222,863	796	.358

Two years ending April 30, 1907:		
Water	acre-feet	3,829,210
Sediment	do	17,020
Ratio	per cent	0.445
Mean of all sediment determinations (0.853 by weight)	do	.626

Although many of the eccentricities of the daily results are smoothed out in the monthly summaries, there still seems to be no relation between discharge of water and sediment that should be taken for general application. For the entire period of two years the mean sediment-to-water ratio, by volume, is 0.445 per cent. It is believed that this ratio may be applied to the annual discharge in finding the quantity of sediment for any year, with errors due to variation of sediment-water ratio as follows:

Discharge 1,000,000 acre-feet or greater, error not to exceed 50 per cent.
Discharge less than 1,000,000 acre-feet, error not to exceed 100 per cent.

The difference between the ratios 0.445 and 0.626 shown at the bottom of Table 2 affords an excellent illustration of the great errors that are likely to occur in estimates based on the product of mean values for discharge and sediment rather than on the mean of products of discharge and sediment.

During the period for which records are available nearly 80 per cent of the discharge has occurred in years when the flow was more than 960,000 acre-feet. It is therefore stated with a considerable degree of assurance that the use of the ratio 0.445 per cent introduces an error for the period much less than 50 per cent and that an allowance of 50 per cent will cover all errors of observations, assumptions, and meager data. The mean annual flow of the Rio Grande at San Marcial for 12 years beginning with 1897 is 1,138,377 acre-feet (see Table 5, p. 162). Using the above-mentioned ratio, the mean annual sediment discharge for the same period would be 5,070 acre-feet. It is interesting to note that a calculation from the mean of the sediment observations would give results about 40 per cent greater.

THEORETICAL EXTENSION OF ESTIMATES.

The discharge of water and the sediment-to-water ratio for various yearly periods within the two years covered by sediment observations are presented in Table 3. A marked tendency toward decrease of ratio with increase of water discharge is evident. By plotting these values and drawing a straight line through the points it was found that all the ratios scaled from the graph were within 9 per cent of those in Table 3, whereas the mean ratio, 0.445 per cent, varies nearly 25 per cent from one of the ratios in Table 3. A considerable increase in accuracy would therefore seem to be secured by use of the graph.

TABLE 3.—*Annual discharge of water and sediment in acre-feet and sediment-water ratio in per cent for the Rio Grande at San Marcial, New Mexico.*

Year ending—	Water.	Sediment.	Ratio.
1906.			
April 30	2,117,921	9,030	0.427
May 31	1,656,407	8,120	.491
June 30	1,287,203	6,750	.525
July 31	1,369,735	7,220	.527
August 31	1,392,852	7,230	.520
September 30	1,413,103	8,330	.590
October 31	1,476,584	8,670	.588
November 30	1,511,939	8,310	.550
December 31	1,563,737	8,460	.541
1907.			
January 31	1,587,876	8,440	.532
February 28	1,615,883	8,470	.525
March 31	1,651,566	8,540	.517
April 30	1,711,289	7,990	.467

TABLE 4.—*Sediment-water ratios for various values of annual discharge.*

Annual discharge.	Ratio (per cent).	Annual discharge.	Ratio (per cent.)	Annual discharge.	Ratio (per cent).
1,000,000 acre-feet	0.621	1,500,000 acre-feet	0.536	2,000,000 acre-feet	0.449
1,100,000 acre-feet	.604	1,600,000 acre-feet	.518	2,100,000 acre-feet	.431
1,200,000 acre-feet	.587	1,700,000 acre-feet	.500	2,200,000 acre-feet	.414
1,300,000 acre-feet	.569	1,800,000 acre-feet	.483	2,300,000 acre-feet	.387
1,400,000 acre-feet	.552	1,900,000 acre-feet	.466	2,400,000 acre-feet	.380

Table 4 presents the ratios scaled from the graph corresponding to various values for annual discharge. This table covers about 80 per cent of the recorded annual discharge and is apparently correct within 10 per cent for individual years. The data do not warrant extension of the graph to include low-flow years, but it is interesting to note that an extension as a straight line would give a ratio of 0.76 per cent for a discharge of 200,000 acre-feet, which is the minimum recorded annual flow.

Based on Table 4 is the following estimate of the annual discharge of sediment for 12 years, shown in Table 5.

TABLE 5.—*Annual discharge of water in acre-feet, annual discharge of sediment in acre-feet based on the ratios of table 4, and annual discharge of sediment in acre-feet calculated from the ratio 0.445 per cent.*

Year.	Water.	Sediment from ratios of Table 4.	Sediment from ratio 0.445 per cent.
1897	2,215,257	9,080	9,850
1898	964,677	6,070	4,290
1899	239,835	[a] 1,910	1,070
1900	484,324	[a] 3,870	2,160
1901	656,274	[a] 5,250	2,920
1902	200,729	[a] 1,610	890
1903	1,278,069	7,380	5,660
1904	709,796	[a] 5,670	3,160
1905	2,422,008	9,160	10,800
1906	1,563,737	8,130	6,950
1907	2,157,709	9,050	9,590
1908	774,109	[a] 6,190	3,450
Total	13,660,524	73,370	60,790
Mean	1,138,377	6,110	5,070

[a] Ratio 0.8 per cent used.

For comparison, the sediment as calculated from the ratio 0.445 per cent is also shown. In obtaining the values in column 3 for discharges not included in Table 4, the single ratio 0.8 per cent has been used. This ratio seems to be a fair one for the low-flow years and is doubtless not more than 50 per cent in error. Inasmuch as it affects but 20 per cent of the entire flow for the 12 years, this ratio can not introduce an error of more than about 10 per cent in the mean annual sediment discharge for the period—6,110 acre-feet. It is believed that this mean, which corresponds to a mean annual sediment-to-water ratio of 0.536 per cent, is within 25 per cent of the actual for any long term of years after allowing for all errors.

ACCURACY OF DATA AND ESTIMATES.

The mean monthly values for discharge of water are probably not in error by more than 10 or 15 per cent. The sediment determinations are probably equally accurate. The chief opportunity for error

is owing to the fact that the samples used for sediment determinations do not include material rolled along the bottom of the stream and that a single sample will not represent the true mean condition for the entire cross section. Data on the error so introduced are meager, but the preponderance of evidence indicates that it is not more than 10 per cent. Opinions have frequently been expressed placing the error as high as 50 per cent, but observations available do not support them. The errors of observation, both on stream gaging and sediment determinations, are likely to offset one another, except for the omission of material rolled along the bottom of the stream. There seems to be reason therefore to believe that the monthly averages of the silt carried and of the water-to-sediment ratio are likely to be correct within 10 or 15 per cent. The yearly results and those for the entire period of 2 years may reasonably be expected to be still more accurate.

The error in assuming that the conditions for 2 years may be applied to those of 12 years, and that those of 12 years may be applied to hundreds of years is problematical. The mean annual flow for the 12 years differs by a maximum of about 33 per cent from the mean of any 6 years for which flow records are available, but by less than 26 per cent from the mean of any 8 years and by less than 11 per cent from the mean of any 9 years. Successions of low-flow years and series of high-flow years are included and it is to be expected that the cycle of changes in flow is fairly complete. In a catchment area so large and subject to normal arid conditions there is always, however, the possibility of abnormal conditions for a few years overthrowing even long-term averages.

The assumption that 85 pounds of suspended matter will produce a cubic foot of sediment may introduce an error. When newly deposited as little as 50 pounds of sediment may occupy a cubic foot of space.[a] At the other extreme it may require 120 pounds of compact dry earth to make a cubic foot. The value 85 pounds to the cubic foot may therefore be in error in individual cases by as much as 40 per cent. When sediment is compacted through a long term of years and is subject to alternate wet and dry conditions, however, the limits of weight and volume are greatly reduced. The value 85 pounds to the cubic foot supposes voids of 48 per cent and a weight of wet sediment of 115 pounds to the cubic foot. It corresponds to the commonly accepted value for weight of mud and dredged material and is probably not more than 15 per cent in error for long-term sediment deposits in any large reservoir in the United States.

[a] See sediment estimates for Rio Grande in Third Ann. Rept. U. S. Reclamation Service.

ROCK MATTER, SOIL, AND SEDIMENT.

In the foregoing discussion 6,110 acre-feet was estimated as the probable mean annual discharge of sediment for the Rio Grande for any long term of years. This estimate relates particularly to reservoir filling capacity, being based on the assumption that 85 pounds of suspended matter will occupy a cubic foot of space. However, if reduced to the state of rock matter, about 165 pounds would be required to fill a cubic foot; if reduced to the state of soil matter, about 100 pounds would be required; and if expanded to the state of freshly-deposited sediment, only about 60 pounds would be required. The probable mean annual discharge for a long term of years may therefore be variously expressed as representing 11,300,000 tons of suspended matter, 3,150 acre-feet of rock matter, 5,200 acre-feet of soil, 6,110 acre-feet of compacted sediment, or 8,650 acre-feet of freshly deposited sediment.

THE INDUSTRIAL APPLICATION OF WATER ANALYSES.[a]

By Herman Stabler.

Recent practice among water analysts tends toward the statement of analyses in ionic form, in parts per million, and the abolition of the statement in grains per gallon of mineral salts supposed to be present. The interpretation of the analysis can be made from either form of statement without great difficulty. The newer form, although admittedly better in many respects than the old, is, nevertheless, comparatively unfamiliar to many, and its interpretation is consequently somewhat obscure. Herewith are presented a few simple calculations and formulas which will assist in clearing up this obscurity and enable one not well grounded in chemical nomenclature to interpret and compare analyses expressed in ionic form, in parts per million, and to classify waters for industrial purposes. The calculations and formulas presented relate to the soap consuming power of water, to water softening, and to the interpretation of analyses with respect to the use of water in boilers and for irrigation, and may be readily enlarged in scope to include all industrial water problems.

THE ANALYSIS.

A mineral analysis of waters such as are ordinarily used for industrial purposes includes four classes of water impurities—suspended matter, colloidal matter, dissolved solids, and dissolved gases.

Suspended matter includes all organic or inorganic matter that can be removed by filtering. It is of a complex nature and consists of many chemical compounds which are not usually determined in detail. Two determinations relating to suspended matter are often made. The first is turbidity (Tu), the figures for which indicate the number of parts per million of a known standard suspended matter that will be just as cloudy or obscure just as much light as the water under consideration. The second is suspended matter (Sm) and represents the actual weight of the suspended matter in the water. If the particles in suspension are very fine, a comparatively small

[a] Revision of an article printed in the Engineering News, vol. 60, p. 355, 1908.

weight will produce a high turbidity. The ratio of turbidity to suspended matter, therefore, is a measure of the average weight or size of the particles in suspension. This ratio is called the coefficient of fineness (Fi).

$$(1)\ Fi = \frac{Tu}{Sm}$$

The greater the value of this coefficient the greater will be the average weight of the suspended particles, and hence the greater will be the ease with which they can be removed.

Colloidal matter includes, for the most part, silica (SiO_2), alumina (Al_2O_3), and iron oxide (Fe_2O_3), though in polluted waters and in some normal waters a considerable amount of organic matter may be present in the colloidal state. This material is present in a state intermediate between suspension and true solution. In the mineral analysis it is not distinguished as such; but the three mineral components above mentioned are determined separately, as though present in solution. There is always some doubt as to whether the silicon, aluminum, and iron are actually present as oxides in the colloidal state or as radicles in true solution. Silicon is rarely, if ever, present in true solution; aluminum forms a part of the system of dissolved solids only in acid waters; and iron is in true solution chiefly in ground waters, and then only in small quantity except in acid waters. In this article the iron and aluminum are included both in the dissolved and colloidal matter in order that both possible occurrences may be covered; but the silicon, because of its very rare occurrence in appreciable quantity in any other form, is included only under the head of colloidal matter. As stated later, the individual analysis may indicate definitely the state of these substances; but it is a safe rule to consider them as being present in the colloidal state. The term "colloidal matter," as here used, means the oxides of silicon, iron, and aluminum and will be designated Cm.

Dissolved gases (Dg) are not determined in many analyses. Oxygen (O), nitrogen (N), and carbon dioxide (CO_2) are generally present in water, and hydrogen sulphide (H_2S) and a few other gases are not unusual. Of these carbon dioxide is most important industrially and will alone be considered, expressed in parts per million.

Dissolved solids (Ds), as here used, refers to the mineral solids actually dissolved in the water. The usual determinations included under this term are iron (Fe), aluminum (Al), calcium (Ca), magnesium (Mg), sodium (Na), potassium (K), acidity (H), carbonate radicle (CO_3), bicarbonate radicle (HCO_3), sulphate radicle (SO_4), chlorine (Cl), and nitrate radicle (NO_3). Acidity is variously reported as hydrochloric acid (HCl), sulphuric acid (H_2SO_4), calcium carbonate ($CaCO_3$), and hydrogen (H). It is here expressed as hydrogen

and may be converted to this form from the others by the following factors:

$$H = .0276\ HCl = .0206\ H_2SO_4 = .0202\ CaCO_3.$$

The first seven of these are called positive radicles and the remaining five negative radicles. Taken together the twelve constitute a chemical system of positive and negative radicles (which may or may not be in actual combination), each of which has the power to react with or hold in the system a definite weight of radicles of the opposite sign. This power will be designated the "reaction coefficient" (r) of that radicle. The reaction coefficient may be defined as the ratio of the capacity for reaction to the weight of a chemical substance, and therefore represents the capacity for reaction of a unit weight of the substance. It is measured in more commonly used terms by the ratio of the valence to the atomic weight of the radicle.

(2) Reaction coefficient, $r = \frac{\text{valence}}{\text{atomic weight}}$

The division into positive and negative radicles and the reaction coefficients of the radicles as used in calculating the international atomic weights of 1909 are as follows:

Positive radicles.	Reaction coefficients.	Negative radicles.	Reaction coefficients.
Ferrous iron (Fe)	0.0358	Carbonate (CO_3)	0.0333
Aluminum (Al)	.1107	Bicarbonate (HCO_3)	.0164
Calcium (Ca)	.0499	Sulphate (SO_4)	.0208
Magnesium (Mg)	.0822	Chlorine (Cl)	.0282
Sodium (Na)	.0435	Nitrate (NO_3)	.0161
Potassium (K)	.0256		
Hydrogen (H)	.992		

If the number of parts per million of each radicle found by analysis be multiplied by its reaction coefficient, a number will be obtained which may be called the "reacting value" of the radicle for that analysis. This will be designated by the letter r prefixed to the symbol of the radicle. Thus, rCa will represent the reacting value of the calcium in any analysis. The symbols of the radicles are used in this paper merely as abbreviations.

The use of the reaction coefficients and reacting values[a] is of great assistance in an attempt to evaluate the effect of mineral impurities on the industrial uses of water. For example, the accuracy of the determinations of an analysis may readily be estimated from the reacting values of the radicles, for in the chemical system which they form the sum of the reacting values of positive radicles must be

[a] The expression of water analyses in terms of reacting values as well as in parts per million has not come into general use, though it has been used and recommended by prominent German chemists for many years.

equal to the sum of the reacting values of the negative radicles. The percentage error due to inaccurate analysis, undetermined radicles, etc., may be found from the formula:

$$(3)\quad e = 100\,\frac{rp - rn}{rp + rn}$$

in which e = percentage error, rp = sum of reacting values of positive radicles, and rn = sum of reacting values of negative radicles. In this calculation iron and aluminum should be omitted, the assumption being that these substances are present as colloidal oxides. Usually, with fairly careful work, e will not exceed 5 in numerical value for waters containing 100 or more parts per million of dissolved solids, and may generally be expected to be 2 or less. A value of e in excess of 5 will indicate: (1) A blunder in analysis or calculation; (2) if negative, the presence of iron, aluminum, or some undetermined positive radicle; or (3) if positive, the presence of silicate or some undetermined negative radicle. Individual judgment must decide which of these causes of error is the most probable and reject the analysis or correct the form of statement in accordance with the magnitude and character of the error and the relative abundance of the radicles likely to be involved. The correction of an analysis in this manner is generally an unreliable makeshift if the error is large, but can occasionally be made with a high degree of probability.

The determinations usually made in examining water for its mineral impurities are summarized below:

	Symbol.
1. (*a*) Suspended matter	Sm
(*b*) Turbidity	Tu
2. Collodial matter	Cm
(*a*) Silica	SiO_2
(*b*) Iron oxide	Fe_2O_3
(*c*) Alumina	Al_2O_3
3. Dissolved gases	Dg
(*a*) Carbon dioxide	CO_2
(*b*) Hydrogen sulphide	H_2S
4. Dissolved radicles	Ds
(*a*) Iron	Fe
(*b*) Aluminum	Al
4. Dissolved radicles—Continued.	
(*c*) Calcium	Ca
(*d*) Magnesium	Mg
(*e*) Sodium	Na
(*f*) Potassium	K
(*g*) Hydrogen	H
(*h*) Carbonate	CO_3
(*i*) Bicarbonate	HCO_3
(*j*) Sulphate	SO_4
(*k*) Chlorine	Cl
(*l*) Nitrate	NO_3

SOAP-CONSUMING POWER.

Whipple [a] has deduced from a series of experiments the cost of consumption of the common household soaps by waters of various degrees of hardness. Iron, aluminum, calcium, magnesium, and

[a] Whipple, G. C., The value of pure water, John Wiley & Sons, New York, 1907; pp. 24–28.

hydrogen radicles in solution are the soap-consuming constituents of water. Therefore, accepting Whipple's values, the cost in cents per 1,000 gallons for soap necessary to produce a lather in water is as follows:

(4) Soap cost

$$= 11 + 50.05\ (rFe + rAl + rCa + rMg + rH)$$
$$= 11 + 1.79\ Fe + 5.54\ Al + 2.5\ Ca + 4.11\ Mg + 49.6\ H.$$

WATER SOFTENING.

Hard water has such a deleterious effect in most industries that the practice of "softening" the water before use has become prevalent in regions where soft waters are not obtainable. The principal so-called hardening constituents are calcium and magnesium, and by reason of their cheapness lime and soda ash are the chemicals customarily used in the softening process. The lime is introduced as the hydroxide, $Ca(OH)_2$, and the soda ash as Na_2CO_3. By the soda-lime method of softening, the hydrogen is changed to water; calcium, magnesium, iron, and aluminum are removed as precipitates; the bicarbonate radicle and carbon dioxide are changed to carbonate radicle and water; and part or all of the carbonate radicle removed as a precipitate. The calcium added as $Ca(OH)_2$, as well as that already in the water, is precipitated as calcium carbonate ($CaCO_3$). The sodium added as Na_2CO_3 remains in solution, taking the place of bases precipitated or otherwise removed from the chemical system. The reactions that apparently take place are:

$Fe + 2OH = Fe(OH)_2$, which falls as a precipitate.
$Al + 3OH = Al(OH)_3$, which falls as a precipitate.
$Mg + 2OH = Mg(OH)_2$, which falls as a precipitate.
$Ca + CO_3 = CaCO_3$, which falls as a precipitate.
$H + OH = H_2O$.
$HCO_3 + OH = CO_3 + H_2O$.
$CO_2 + 2OH = CO_3 + H_2O$.

From the foregoing reactions, it appears that lime must be added in quantity sufficient to provide hydroxyl (OH) to combine with the iron, aluminum, magnesium, bicarbonate, and hydrogen radicles and carbon dioxide. In addition, if the carbonate radicle in the water plus that formed by change of bicarbonate radicle and carbon dioxide is not sufficient to precipitate the calcium present in the water, and added as lime, an additional quantity must be provided by the addition of soda ash in order that all the calcium may be precipitated. This latter consideration determines the amount of soda ash to be added. In terms of pounds of 90 per cent lime (CaO) and 95 per

cent soda ash (Na_2CO_3) per 1,000 gallons of water, these statements may be expressed in the following formulas:

(5) Lime required

$= 0.26\ (rFe + rAl + rMg + rH + rHCO_3 + .0454\ CO_2)$

$= .00931\ Fe + .0288\ Al + .0214\ Mg + .258\ H + .00426\ HCO_3 + .0118\ CO_2.$

(6) Soda ash required [a]

$= 0.465\ (rFe + rAl + rCa + rMg + rH - rCO_3 - rHCO_3)$

$= .0167\ Fe + .0515\ Al + .0232\ Ca + .0382\ Mg + .462\ H - .0155\ CO_3 - .00763\ HCO_3.$

Assuming the average cost of lime to be 0.3 cents and of soda ash to be 1.2 cents per pound, the cost in cents per 1,000 gallons of chemicals for softening a water can readily be determined from formulas (5) and (6), as follows:

(7) Cost of chemicals for softening

$= .636\ (rFe + rAl + rMg + rH) + .558\ (rCa - rCO_3) + .00354\ CO_2 - .48\ rHCO_3$

$= .0228\ Fe + .0704\ Al + .0522\ Mg + .631\ H + .0279\ Ca + .00354\ CO_2 - .0186\ CO_3 - .00787\ HCO_3.$

A negative value for formula (6) shows that no soda ash is required. In such case, instead of using formula (7), take .3 the value of formula (5) for cost of chemicals. Formulas (4), (5), (6), and (7) may usually be simplified for practical use by the omission of iron, aluminum, and hydrogen, for they are not often present in sufficient quantity to affect the results. Total incrustants in parts per million (as determined by the standard method of the American Public Health Association) multiplied by .0093 will be practically equal to the value of formula (6).

Similar formulas can readily be deduced for use in connection with water softening by other chemicals, but their practical application would be small. In connection with the water-softening problems, it should be remembered that the reactions quoted above and the resulting precipitation will vary in completeness with conditions of temperature, mixing, sedimentation, etc. Furthermore, the precipitates formed are not wholly insoluble. In a water softened under ideal conditions there may remain in solution 5.2 parts per million of calcium and 3.4 parts per million of magnesium, together with equivalent amounts of negative radicles. These figures may be

[a] The use of soda ash in water softening results in an increase of the highly soluble constituents, for the sodium thus added remains in solution. In some industrial uses of water a great increase in content of sodium is accompanied by very undesirable results; and if the water contains a large amount of the sulphate radicle, barium carbonate ($BaCO_3$) may be substituted for all or a part of the soda ash to advantage. In such waters the minimum amount of soda ash to be used is, in pounds per 1,000 gallons, $.0131\ Cl + .0075\ NO_3 - .0202\ Na - .0119\ K$. A negative value for this expression shows that the barium compound may be used for all of the soda ash required by formula (6), and if the expression be positive its value should be subtracted from the value of formula (6) to find the amount of soda ash for which barium carbonate may be used. In the substitution, 1.77 pounds of barium carbonate must be used in place of each pound of soda ash and the cost will be increased by 2.7 cents for each pound of soda ash replaced.

increased by the presence of other substances. On the other hand, a very large percentage of colloidal and suspended matter will be carried down with the precipitates, thus increasing the value of the softening process.

BOILER WATERS.

The chief industrial use of water is steam making. The cost of softening water is a fairly reliable index to its value for this and many other industrial purposes. The cost for softening is the sum of two figures—cost for lime and cost for soda ash, the former being about one-fourth the latter. In a general way, the amount of lime required varies with the amount of least objectionable impurities, while the amount of soda ash required varies with the quantity of impurities most deleterious in character. If, therefore, the ill effects of the latter class may be assumed as four times those of the former, the relative cost of chemicals for softening waters will represent their relative objectionableness with a fair degree of accuracy.

The customary method of interpreting the value of a water for boiler use is based on its tendency to cause foaming, corrosion, and incrustation. Such interpretation is usually made from the hypothetical combination of the radicles as salts, judgment of the tendencies of these salts being made in accordance with our knowledge or theories of boiler physics. Unfortunately our knowledge is rather restricted though our theories are numerous. It follows that the interpretation can not always be expressed in very definite terms and if so expressed is liable to error.

FOAMING AND PRIMING.

Foaming and priming are probably the least understood of boiler phenomena. Priming may be defined as an ebullition so violent that water in the form of spray is carried from the boiler before its separation from the steam can take place. It is controlled by the relations of heating surface, evaporation surface, circulation, and working load, all of which are factors of the violence and rapidity of ebullition, and by such features as dash plates, water space, and steam space, all of which affect the possibility of violently boiling water reaching the steam exit. Priming, as thus defined, is a matter of boiler design and operation.

Foaming is the formation of bubbles upon and above the surface of the water. The less easily these bubbles break the higher will the foam rise. It may become so excessive that the bubbles, or films of water inclosing steam, pass out with the steam.

Naturally priming, or a tendency to prime, is an important factor in excessive foaming. Aside from this, the difficulty with which the

steam pushes through the surface film of water and separates from it is a controlling agency. With little mineralized water foaming is very slight and never sufficient to cause the loss of water with steam in a well designed boiler. Nearly all impurities dissolved or suspended in water increase the foaming tendency, though no two substances may do so to the same degree. As steam is used from the boiler the impurities are concentrated and finally a stage is reached which will cause excessive foaming. If, therefore, the quantity of impurities and the effect of each were known, the calculation of the foaming tendency of a water would be a simple matter. Unfortunately, our knowledge of this department of boiler physics is very slight. It is practically impossible to determine the quantity of suspended matter in a boiler at any time. Suspended matter originally present in the water is largely precipitated, while additional suspended matter is derived from loosened scale and from the precipitation of impurities in solution in the feed water. Organic matter holds a similar indefinite place in connection with foaming calculations because a large but unknown proportion is precipitated. It is, however, usually present in relatively small amount in boiler waters. Although both these classes of substances are undoubtedly important, the effect of precipitated magnesium being especially noteworthy, their rôle in inducing foaming can not, therefore, be calculated from an analysis of boiler feed water. For this reason and because all other dissolved substances are relatively insignificant in amount in a highly concentrated boiler water it is generally customary to attribute foaming to sodium and potassium salts. These substances are highly soluble and their relative importance in different waters is easily determined from analyses. The expression $2.7Na+2K$ will represent these salts generally within 5 per cent and always within 15 per cent. It will correspond very closely to the "nonincrusting solids" usually estimated from hypothetical combinations and is sufficiently accurate for practical use. Since these compounds are at best a rough approximation of the foaming tendency of a water, nothing would be gained by the use of a more cumbersome expression from which they could be more accurately estimated. The following formula may, therefore, be adopted:

(8) Foaming coefficient $f=62rNa+78rK=2.7Na+2K$.

It is to be hoped that investigation may lead to a better understanding of this phenomenon and hence to a more reliable index to the foaming tendency of waters.

The steam engineer is interested more in the number of hours his boiler may be run under ordinary load without danger of foaming

than in the coefficient given above. This is really a combined index of priming and foaming and may be calculated from the formula:

(8*a*) Run in hours: $Rh = \frac{a}{b}\left(\frac{c}{f} - 1\right)$,

in which a = water capacity of boiler, b = hourly quantity of feed water used, f = foaming coefficient, and c is a constant which represents in parts per million the concentration of salts that will cause excessive foaming in the type of boiler under consideration.

The usual remedy for foaming is blowing off a portion of the highly impure water and replacing it with fresh feed water. If a in the foregoing formula be made to represent the amount of water blown off at any time, the expression will indicate the length of time that may with safety elapse before blowing off again.

The following approximate values have been determined for the constant c for various types of boilers and are here adapted from Christie's "Boiler waters."

Locomotive boiler	2,500 to 3,500
Stirling boiler	4,000 to 5,000
Modern water-tube boiler (such as the Babcock & Wilcox or Heine)	5,000 to 7,000
Horizontal return tubular boiler	8,000 to 10,000
Old-style two-flue boiler	17,000

From these figures it appears that the locomotive boiler is the type most likely to give trouble on account of foaming and offers, therefore, a satisfactory basis for an arbitrary classification of waters according to their foaming tendency. A nonfoaming water may be defined as one that can be used in a locomotive boiler throughout one week's work without foaming; a semifoaming water as one that can not be used so long as a week, but one that will require one complete water change to avoid foaming in a locomotive boiler not oftener than every two days; and a foaming water as one that can not be used so long as two days in a locomotive boiler without blowing off or changing water to prevent foaming. Accepting these conditions, the following approximate classification of waters will result:

(1) Nonfoaming; f not greater than 60.
(2) Semifoaming; f greater than 60, but not greater than 200.
(3) Foaming; f greater than 200.

CORROSION.

Corrosion of a metal will occur in the presence of water if the metal is capable of replacing any positive radicle in the chemical system which the dissolved matter in the water constitutes. The radicle thus replaced may pass from solution as a precipitate or a gas. In boiler corrosion the metal to be considered is the iron of the boiler. The radicle which it may replace in the chemical system of dissolved solids is hydrogen, which, when so replaced leaves the chemical system

as hydrogen gas. It follows that the amount of hydrogen radicle in the chemical system under boiler conditions is the controlling factor of corrosion. The calculation of this factor can be made with a fair degree of accuracy. Under boiler conditions the dissolved gases are driven out with the steam. Therefore, although some of these substances are prominent corrosive agents when confined they are omitted from consideration here.

Hydrogen radicle as determined by analysis is the first item. It may be the cause of corrosion in the cold or under boiler conditions. To this may be added, as a result of the high temperature in a boiler, three molecules of hydrogen for each molecule of aluminum, two of hydrogen for one of iron, and two of hydrogen for one of magnesium. The reactions involved may be represented by the following equations:

$$2Al + 3H_2O = Al_2O_3 + 6H$$
$$Fe + H_2O = FeO + 2H$$
$$Mg + H_2O = MgO + 2H$$

These reactions probably do not occur in just this way, but they express well-known results. There are other reactions that may cause an increase in the amount of hydrogen radicle. While they will not be considered in the calculations which follow, the three given below are of interest as expressing possibilities:

$$2Fe + 3H_2O = Fe_2O_3 + 6H$$
$$3Fe + 4H_2O = Fe_3O_4 + 8H$$
$$SiO_2 + H_2O = SiO_3 + 2H$$

In all of these equations, except the last, the hydrogen is represented as being brought into the chemical system to replace a radicle precipitated as an oxide. In the last equation, hydrogen and silicate radicles are both brought into the system. In all cases, of course, the equilibrium between positive and negative radicles in the system must be maintained.

Opposed to these reactions increasing the amount of hydrogen are others tending to decrease it. Thus under boiler conditions each molecule of carbonate radicle may combine with two molecules of hydrogen and each molecule of bicarbonate radicle with one molecule of hydrogen to form water and the gas carbon dioxide. This is illustrated by the following equations:

$$H + HCO_3 = H_2O + CO_2$$
$$2H + CO_3 = H_2O + CO_2$$

Thus positive and negative radicles leave the chemical system together.

The carbon dioxide so formed will pass off with the steam.

The two sets of phenomena may be combined to represent the residual hydrogen likely to be replaced in the chemical system by iron from the boiler, as follows:

(9) Coefficient of corrosion:

$$c = 1.008\ (rH + rAl + rFe + rMg - rCO_3 - rHCO_3)$$
$$= H + .1116\ Al + .0361\ Fe + .0828\ Mg - .0336\ CO_3 - .0165\ HCO_3$$

One of the first occurrences in a boiler is the precipitation of at least a part of the carbonate and bicarbonate radicles as calcium carbonate. Such precipitate can be acted upon, the calcium being returned to the chemical system to replace the hydrogen which forms water and carbon dioxide with the carbonate radicle. The extent of such action is not well defined. With a maximum precipitation of calcium carbonate and a minimum action upon the same, the effect of the carbonate and bicarbonate radicles in the above formula may be reduced by 1.008 rCa or .0503 Ca. The foregoing considerations afford an excellent basis for the classification of waters according to their corrosive tendencies. Three classes may be distinguished as follows:

(1) Corrosive. If c be positive, the water will certainly corrode the boiler.

(2) Noncorrosive. If $c + .0503$ Ca be negative, no corrosion will occur on account of the mineral constituents in the water.

(3) Semicorrosive. If c be negative, but $c + .0503$ Ca be positive, corrosion may or may not occur, the probability of corrosive action varying directly with the value of the expression $c + .0503$ Ca.

SCALE FORMATION.

The formation of scale and sludge in boilers is the most common effect of the use of impure feed water. This phenomenon is the result of heating the water to a high temperature and concentrating it. The heat reduces the solubility of many of the dissolved substances to such an extent that they leave the chemical system. Concentration may gradually increase the amount of dissolved matter to saturation, after which additional concentration will cause it to pass out of solution. Suspended matter and colloidal matter are also largely deposited within the boiler.

The purest of natural waters, if used in a boiler for a great length of time without cleaning, would produce scale or sludge. As boilers are usually operated, temperatures and concentrations are permitted which result in the precipitation of practically all suspended and colloidal matter—all iron, aluminum, magnesium, and all calcium to the full extent of its ability to combine with carbonate, bicarbonate, and sulphate radicles. The iron, aluminum, and magnesium appear in the scale as oxides (magnesium carbonate may be present, but is not likely to be found in quantity in scale from high-pressure boilers),

while the calcium may be present as calcium carbonate or calcium sulphate (a hydrated calcium sulphate frequently occurs, but in the modern high-pressure boiler its quantity is sufficiently small to be neglected). Whether these results are caused by a series of reactions or by a single chemical change is of little moment in connection with boiler calculations. The following reactions, therefore, are presented not as formulas for the changes which actually take place, but as equations which express the known results of changes that occur within the boiler:

$$2Al + 3H_2O = Al_2O_3 + 6H$$
$$Fe + H_2O = FeO + 2H$$
$$Mg + H_2O = MgO + 2H$$
$$Ca + CO_3 = CaCO_3$$
$$Ca + 2HCO_3 = CaCO_3 + H_2O + CO_2$$
$$Ca + SO_4 = CaSO_4$$
$$H + HCO_3 = H_2O + CO_2$$
$$2H + CO_3 = H_2O + CO_2$$

The hydrogen in the last two equations may include not only the hydrogen radicle found by analysis, but also that developed by the first three equations. In other words, it is c, the coefficient of corrosion. An estimate of the amount of scale formed is necessarily rather uncertain. The first three reactions may, without great error, be assumed to be practically complete. The division of carbonate and bicarbonate radicles between calcium and hydrogen, and the division of the calcium between carbonate and sulphate radicles, are not definitely known and probably vary with different conditions of boiler operation. On this account it would seem desirable to estimate maximum and minimum values for scale formed by calcium compounds. Formulas were prepared with this in view, but the difference between maximum and minimum values was found to be small in nearly every instance. The use of the necessarily cumbersome formulas was therefore discarded in favor of one which represents a probable average scale-forming value. Calculations based upon this formula are relatively simple, and it is believed that they are of as great practical value as the maximum and minimum formulas. In order to conform to common usage the formula is in terms of pounds of scale per 1,000 gallons of water.

(10) Scale (Sc)

$$= .00833\ Sm + .00833\ Cm + .3\ rFe + .142\ rAl + .168\ rMg + .492\ rCa$$
$$= .00833\ Sm + .00833\ Cm + .0107\ Fe + .0157\ Al + .0138\ Mg + .0246\ Ca$$

In this formula the value of rCa used should not be in excess of $rCO_3 + rHCO_3 + rSO_4$. (Ca should not exceed $.668\ CO_3 + .328\ HCO_3 + .417\ SO_4$).

Formula (10) shows the amount of scale and sludge likely to be deposited in a boiler operated under the usual conditions of modern practice

and its value will never differ widely from the "total incrusting matter" frequently reported from an estimation of hypothetical combinations of radicles. It is of equal importance to know whether the matter deposited will form a hard scale. The following formula shows in pounds per 1,000 gallons the probable amount of hard-scale forming material in the scale:

(11) Hard scale (Hs)

$= .00833\ SiO_2 + .168\ rMg + .567\ (rCl + rSO_4 - rNa - rK)$

$= .00833\ SiO_2 + .0138\ Mg + (.016\ Cl + .0118\ SO_4 - .0246\ Na - .0145\ K)$

The value used for the parenthesis of this formula must not exceed rSO_4 or rCa ($.0118\ SO_4$ or .0283 Ca in the second form) nor should it be less than zero.

Dividing the value of formula (11) by the value of formula (10), a factor will be obtained which may be called the coefficient of scale hardness. This factor shows the proportion of the total scale that is likely to form a cement-like substance upon the boiler tubes and is therefore an index to the probable hardness of the scale that will be deposited. Thus:

(12) Coefficient of scale hardness, $h = \frac{Hs}{Sc}$

From formulas 10, 11, and 12, waters may be classed as follows:

(1) Soft scale: h not more than .25.

(2) Medium scale: h more than .25 but not more than .5.

(3) Hard scale: h more than .5.

In addition, the following classification may be used as a prefix to the preceding:

(1) Very little: Sc not more than 1.

(2) Little: Sc more than 1, but not more than 2.

(3) Much: Sc more than 2, but not more than 4.

(4) Very much: Sc more than 4.

IRRIGATING WATERS.

An excess of alkali in the soil is detrimental to the growth of crops, and waters used in irrigation may seriously impair the fertility of land by augmenting its alkali content. Land would probably be injured by the best of natural waters if irrigated with them for a long period of time without natural or artificial drainage, for all irrigating waters contain alkali, and evaporation in and from the soil would result in a gradual accumulation of toxic salts. In order that waters may readily be compared with respect to their suitability for irrigation, a simple index of their irrigating value should be available. The calculation of such an index, designated the "alkali coefficient," is developed in the following paragraphs. The alkali coefficient is a purely arbitrary quantity intended solely to

facilitate the comparison of waters to be used for irrigation. It may be defined as the depth in inches of water which, on evaporation, would yield sufficient alkali to render a 4-foot depth of soil injurious to the most sensitive crops. Thus, if the alkali coefficient of a water is found to be 17, 17 inches in depth of that water contains sufficient alkali to render injurious to sensitive crops the soil on which it is applied. Whether injury would actually result from the application of such a water to any particular piece of land, however, depends on methods of irrigating, the crops grown, the character of the soil, and drainage conditions, and it should be clearly understood that the alkali coefficient in no way takes account of such conditions.

Hilgard [a] quotes results of investigations by R. H. Loughridge showing the greatest amount of various alkali compounds found in soils in which crops were not injured. About forty common cultures were included in the tables, and great diversity is indicated for the relative toxicity of the compounds toward the different cultures. The mean results for several cultures of about the same degree of sensitiveness, however, indicate with marked uniformity the relative toxicity of the alkalies toward common cultures to be about as follows: Sodium as Na_2CO_3, 10;[b] sodium as NaCl, 5; sodium as Na_2SO_4, 1. The investigations indicate further that about 1,500 pounds per acre of sodium with a relative toxicity of 1 (as above) in 4 feet depth of soil is barely sufficient to affect injuriously the more sensitive common crops. The foregoing conclusions, being in accord with the results of other investigations, will be used as a basis for the calculation of the alkali coefficient, which may be made from a water analysis by means of the following formulas:

(13*a*) When rNa − rCl or Na − .65 Cl is zero or negative,

$$\text{Alkali coefficient, } k = \frac{288}{5rCl} = \frac{2040}{Cl}$$

(13*b*) When rNa − rCl or Na − .65 Cl is positive but not greater than rSO_4 or .48 SO_4,

$$\text{Alkali coefficient, } k = \frac{288}{rNa + 4rCl} = \frac{6620}{Na + 2.6Cl}$$

(13*c*) When rNa − rCl − rSO_4 or Na − .65 Cl − .48 SO_4 is positive,

$$\text{Alkali coefficient, } k = \frac{288}{10rNa - 5rCl - 9rSO_4} = \frac{662}{Na - .32\ Cl - .43\ SO_4}.$$

In the foregoing formulas, the sodium and potassium value reported in many analyses may be used for Na; in the absence of a

[a] Hilgard, E. W., Soils, p. 467, 1906.

[b] The tables indicate a relative toxicity of about 6, but on account of the puddling effect of sodium carbonate on soils and the fact that the investigations did not distinguish between bicarbonate and carbonate of sodium, the value 10 is believed to be more satisfactory.

sodium or a sodium and potassium determination, Na may be estimated from the equations

$$Na = .41\ HCO_3 - .83\ CO_3 - .71\ Cl - .52\ SO_4 - (1.25\ Ca + 2.06\ Mg)$$
$$rNa = 1.10\ [rHCO_3 + rCO_3 + rCl + rSO_4 - (rCa + rMg)]$$

which for safety give a value about 10 per cent greater than the theoretical; and in the absence of calcium and magnesium determinations, the foregoing equations may be used if the parenthetical expression be replaced by one-half the total hardness (as $CaCO_3$) or its equivalent reacting value.

Formula (13*a*) is applicable to waters that contain more chlorine radicle than is sufficient to combine with the sodium present, and involves the assumption that the other basic radicles required to hold the chlorine radicle in solution are as injurious as if replaced by their equivalent reacting value of sodium. The other formulas neglect possible injurious effects of basic radicles other than sodium. These assumptions, as applied to normal waters, are sufficiently accurate for practical purposes, though their application to soils might lead to serious errors.

Waters to which formulas (13*a*) and (13*b*) are applicable can not be improved by chemical treatment, but are likely to produce only "white alkali" in the soil. Waters to which formula (13*c*) is applicable are likely to produce "black alkali" in the soil and can be improved to the alkali coefficient calculated from formula (13*b*) by the use of gypsum or "land plaster."

In general, injurious results from the use of a water for irrigation depend largely on drainage conditions and soil texture. Waters with low alkali coefficients may be used successfully on a loose soil with free drainage. The following approximate classification, which is based on ordinary irrigation practice in the United States, indicates in a very general way the customary limitations in the use of waters having various alkali coefficients:

Classification of irrigation waters.

Alkali coefficient.	Class.	Remarks.
More than 18	Good	Have been used successfully for many years without special care to prevent alkali accumulation.
18 to 6	Fair	Special care to prevent gradual alkali accumulation has generally been found necessary except on loose soils with free drainage.
5.9 to 1.2	Poor	Care in selection of soils has been found to be imperative and artificial drainage has frequently been found necessary.
Less than 1.2	Bad	Practically valueless for irrigation.

APPLICATIONS.

The foregoing formulas will now be applied to a few analyses, which, for convenience, have been arranged in the form of statement herein suggested.

Below are given the results of calculation of the various formulas presented and classification of the waters in accordance therewith.

Analyses of waters and results of formulas.

[Parts per million.]

	Weights.					Reacting values.				
	A.	B.	C.	D.	E.	A.	B.	C.	D.	E.
1. Suspended matter	30.00	118.00	0.00	14.00	0.00	.....	.....	.....	.....	.....
2. Colloidal matter	3.07	9.36	11.23	13.60	10.80	.....	.....	.....	.....	.....
Silica (SiO_2)	3.00	6.80	11.00	11.00	6.50	.....	.....	.....	.....	.....
Iron oxide (Fe_2O_3)	.07	.06	.23	2.60	4.30	.....	.....	.....	.....	.....
Alumina (Al_2O_3)	.....	2.50	.....	.....	.....	.....	.....	.....	.....	.....
3. Dissolved gas:										
Carbon dioxide (CO_2)	10.00	0.00	7.50	.....	122.00	.....	.....	.....	.....	.....
4. Dissolved radicles:										
Calcium (Ca)	11.00	16.00	64.00	8.30	28.00	0.55	0.80	3.19	0.41	1.40
Magnesium (Mg)	2.80	4.20	12.00	1.80	12.00	.23	.34	.98	.15	.98
Sodium (Na)	4.60	7.90	48.00	9.00	386.00	.20	.34	2.08	.39	16.76
Potassium (K)	1.10	.....	.....	3.00	7.00	.03	.....	.....	.08	.18
Hydrogen (H)	0.00	.08	0.00	0.00	0.00	.00	.08	.00	.00	.00
Sum positive radicles	.....	.....	.....	.....	.....	1.01	1.56	6.25	1.03	19.32
Carbonate (CO_3)	0.00	0.00	Tr.	0.00	238.00	.00	.00	.00	.00	7.93
Bicarbonate (HCO_3)	41.00	0.00	156.00	39.00	162.00	.67	.00	2.55	.64	2.66
Sulphate (SO_4)	6.80	76.00	51.00	5.60	145.00	.14	1.58	1.06	.12	3.02
Chlorine (Cl)	7.00	2.70	97.00	5.80	213.00	.20	.08	2.74	.16	6.00
Nitrate (NO_3)	0.00	1.20	0.40	Tr.	.....	.00	.02	.01	.00	.....
Sum negative radicles	.....	.....	.....	.....	.....	1.01	1.68	6.36	.92	19.61

	A.	B.	C.	D.	E.
3. Error of analysis, e (per cent)	0.0	−3.7	+0.9	+5.6	−0.7
4. Soap cost (cents per 1,000 gallons)	50	72	211	39	130
5. Pounds, 90 per cent lime to soften 1,000 gallons	.35	.11	1.01	.21	2.39
6. Pounds, 95 per cent soda ash to soften 1,000 gallons	.05	.57	.75	.00	.00
7. Cost (cents per 1,000 gallons) of lime and soda ash	.16	.71	1.08	.06	.72
8. Foaming coefficient, f	15	21	130	30	1,057
9. Coefficient of corrosion, c	−.44	.42	−1.58	−.49	−9.69
C+.0503 Ca	.11	1.23	1.63	−.08	−8.28
10. Scale, Sc (pounds per 1,000 gallons)	.59	1.51	1.84	.46	.94
11. Hard scale, Hs (pounds per 1,000 gallons)	.12	.56	.85	.12	.22
12. Coefficient of scale hardness, h	.20	.37	.46	.25	.23
13. Alkali coefficient, k	290	440	22	280	2.6

Analyses B and D seem to be somewhat in error. The errors indicated could be accounted for by the presence of iron and aluminum radicle in the one case and by silicate radicle in the other. The differences are not great enough, however, to warrant a change in the form of statement. Hence iron, aluminum, and silicon are presumed to be present as oxides in the colloidal state.

The following boiler classification of the waters (including a verbal and a numerical classification) will result from the foregoing figures:

(A) (15) Nonfoaming, (−0.44+0.11) semicorrosive, (0.59) very little, (0.20) soft scale.

(B) (21) Nonfoaming, (+0.42+1.23) corrosive, (1.51) little, (0.37) medium scale.

(C) (130) Semifoaming, (−1.58+1.63) semicorrosive, (1.84) little, (0.46) medium scale.

(D) (30) Nonfoaming, (−0.49−0.08) noncorrosive, (0.46) very little, (0.25) soft scale.

(E) (1057) Foaming, (−9.69−8.28) noncorrosive, (0.94) very little, (0.23) soft scale.

The effect of suspended matter upon the scale classification of B is of interest. Neglecting the suspended matter, the class would be "very little hard scale."

For use in irrigation, E would be classed as poor and the others as good.

For detailed comparison or classification of waters, the formulas presented will be found of great value. It is believed that a better general understanding of waters and much practical advantage would result if the analyst were to devote to the foregoing calculations and the resulting classification a portion of the time usually spent in figuring hypothetical combinations.

For those who desire to use the formulas the following notes are of special interest:

(*a*) The reacting values are necessary only in estimating the error of analyses. Other formulas are presented in dual form so that reacting values may be used or not, as desired. Generally their use will shorten the work of calculation.

(*b*) The formulas are well adapted to the use of a slide rule or similar calculating machine. They are for use primarily in connection with analyses expressed in parts per million or milligrams per liter, but can be used for analyses expressed otherwise if such analyses are reduced to parts per million by multiplying by the proper factors, as follows:

Parts per hundred thousand—10.
Grains per U. S. gallon—17.1.
Grains per imperial gallon—14.3.
Pounds per thousand U. S. gallons—120.
Pounds per thousand imperial gallons—100.
Per cent of dissolved solids—total dissolved solids in parts per million or milligrams per liter.

(*c*) The numerical coefficients used in the formulas are the result of the simple mathematical calculations of chemistry. Thus the coefficient 0.26 of formula (5) is derived as follows: It is desired to find the quantity of lime (CaO) that will react with certain substances. The reacting value of this lime must, of course, equal the sum of the reacting values of the substances with which it is to react. The parenthesis of the formula represents this reacting value. The reacting coefficient of CaO being $\frac{1}{28.05}$, our reacting value for lime must be multiplied by 28.05 to give parts per million of CaO. This must in turn be divided by 120 to give pounds per 1,000 gallons. A final division by .90 reduced the expression to terms of lime of 90 per cent purity. Thus $28.05 \times \frac{1}{120} \times \frac{1}{.90} = 0.26$. Other numerical coefficients of the formulas are derived in a similar manner.

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